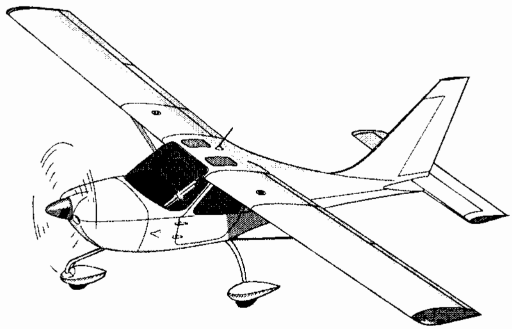
Symphony AIRCRAFT

Trois-Rivières, Canada

SYMPHONY AIRCRAFT INDUSTRIES

Flight Manual
SYMPHONY SA 160



REGISTRATION:

Category of Airworthiness	: Normal
Applicable Airworthiness Requirements	: AWM Chapter 523
Serial No.	: 023 - 042 & S-0001 - up:
Date of Issue	: Feb 25, 2005
Document	: AFM-SAI-SA-160-101001-E

This manual must be carried in the aircraft at all time:Scope and revision status can be found in the list of Effective Pages and in the Record of Revisions.
The pages identified as "DOT-appr." in the List of Effective Page are approved by:

Signature	William Jupp Chief, Flight Test For Director, Aircraft Certification
Authority	Transport Canada
Date of approval	February 25, 2005

This Flight manual contains the Transport Canada approved regulatory information required by CAR 523 and FAR 23. Compliance with Section 2 "Limitations" is mandatory.

Approved
Transport Canada

Issued: Feb 25, 2005

APPLICABILITY

This handbook contains information applicable to the model SA 160 aircraft designated by serial number and registration number shown on the title page.
All information is based on data available at the time of delivery of your aircraft by Symphony Aircraft Industries Inc.

NOTE: A current handbook must be in the aircraft during flight. It is the operator's responsibility to maintain the handbook in a current status.

Revisions

The information in this handbook will be kept current by revisions issued by Symphony Aircraft Industries.
Revision material will contain information necessary to update the text, figures, and charts of the present handbook and/or add information.

1. Incorporating Revisions

Revisions must be incorporated as they are issued. Revision status is noted on List of Revisions page and Log of Effective Pages table in this section.
Revisions shall be inserted into the handbook as follows:

(a) Always replace pages with revision pages of same page number.
(b) Insert additional pages in correct numerical order within each section.

2. Identification of Revised Material

Revisions, additions and deletions will be identified by a vertical black line along the outside of the page opposite only the portion of the printed matter that was changed.

A line along the outside margin of the page beside the page number indicates that non-changed material has a new physical location only.

The date of the revision is shown on each revised page.

LOG OF EFFECTIVE PAGES

The following Log of Effective Pages provides a listing of all effective pages in the POH, as well as the date of issue or revision.

Revision Level	Date of Issue
0 (Original Issue)	Feb 25, 2005

PAGE	DATE	PAGE	DATE
Title	Feb 25, 2005	1-7	Feb 25, 2005
i	Feb 25, 2005	1-8	Feb 25, 2005
ii	Feb 25, 2005	1-9	Feb 25, 2005
iii	Feb 25, 2005	1-10	Feb 25, 2005
iv	Feb 25, 2005	1-11	Feb 25, 2005
v	Feb 25, 2005	1-12	Feb 25, 2005
vi	Feb 25, 2005	1-13	Feb 25, 2005
vii	Feb 25, 2005	1-14	Feb 25, 2005
viii	Feb 25, 2005	2-1	Feb 25, 2005
ix	Feb 25, 2005	2-2	Feb 25, 2005
x	Feb 25, 2005	2-3	Feb 25, 2005
xi	Feb 25, 2005	2-4	Feb 25, 2005
1-1	Feb 25, 2005	2-5	Feb 25, 2005
1-2	Feb 25, 2005	2-6	Feb 25, 2005
1-3	Feb 25, 2005	2-7	Feb 25, 2005
1-4	Feb 25, 2005	2-8	Feb 25, 2005
1-5	Feb 25, 2005	2-9	Feb 25, 2005
1-6	Feb 25, 2005	2-10	Feb 25, 2005

PAGE	DATE	PAGE	DATE
2-11	Feb 25, 2005	4-10	Feb 25, 2005
2-12	Feb 25, 2005	4-11	Feb 25, 2005
3-1	Feb 25, 2005	4-12	Feb 25, 2005
3-2	Feb 25, 2005	4-13	Feb 25, 2005
3-3	Feb 25, 2005	4-14	Feb 25, 2005
3-4	Feb 25, 2005	4-15	Feb 25, 2005
3-5	Feb 25, 2005	4-16	Feb 25, 2005
3-6	Feb 25, 2005	4-17	Feb 25, 2005
3-7	Feb 25, 2005	4-18	Feb 25, 2005
3-8	Feb 25, 2005	4-19	Feb 25, 2005
3-9	Feb 25, 2005	4-20	Feb 25, 2005
3-10	Feb 25, 2005	4-21	Feb 25, 2005
3-11	Feb 25, 2005	4-22	Feb 25, 2005
3-12	Feb 25, 2005	4-23	Feb 25, 2005
3-13	Feb 25, 2005	4-24	Feb 25, 2005
3-14	Feb 25, 2005	4-25	Feb 25, 2005
3-15	Feb 25, 2005	4-26	Feb 25, 2005
3-16	Feb 25, 2005	4-27	Feb 25, 2005
3-17	Feb 25, 2005	4-28	Feb 25, 2005
3-18	Feb 25, 2005	4-29	Feb 25, 2005
3-19	Feb 25, 2005	4-30	Feb 25, 2005
3-20	Feb 25, 2005	4-31	Feb 25, 2005
3-21	Feb 25, 2005	4-32	Feb 25, 2005
4-1	Feb 25, 2005	5-1	Feb 25, 2005
4-2	Feb 25, 2005	5-2	Feb 25, 2005
4-3	Feb 25, 2005	5-3	Feb 25, 2005
4-4	Feb 25, 2005	5-4	Feb 25, 2005
4-5	Feb 25, 2005	5-5	Feb 25, 2005
4-6	Feb 25, 2005	5-6	Feb 25, 2005
4-7	Feb 25, 2005	5-7	Feb 25, 2005
4-8	Feb 25, 2005	5-8	Feb 25, 2005
4-9	Feb 25, 2005	5-9	Feb 25, 2005

PAGE	DATE	PAGE	DATE
5-10	Feb 25, 2005	7-4	Feb 25, 2005
5-11	Feb 25, 2005	7-5	Feb 25, 2005
5-12	Feb 25, 2005	7-6	Feb 25, 2005
5-13	Feb 25, 2005	7-7	Feb 25, 2005
5-14	Feb 25, 2005	7-8	Feb 25, 2005
5-15	Feb 25, 2005	7-9	Feb 25, 2005
5-16	Feb 25, 2005	7-10	Feb 25, 2005
5-17	Feb 25, 2005	7-11	Feb 25, 2005
5-18	Feb 25, 2005	7-12	Feb 25, 2005
5-19	Feb 25, 2005	7-13	Feb 25, 2005
5-20	Feb 25, 2005	7-14	Feb 25, 2005
5-21	Feb 25, 2005	7-15	Feb 25, 2005
5-22	Feb 25, 2005	7-16	Feb 25, 2005
5-23	Feb 25, 2005	7-17	Feb 25, 2005
5-24	Feb 25, 2005	7-18	Feb 25, 2005
6-1	Feb 25, 2005	7-19	Feb 25, 2005
6-2	Feb 25, 2005	7-20	Feb 25, 2005
6-3	Feb 25, 2005	7-21	Feb 25, 2005
6-4	Feb 25, 2005	7-22	Feb 25, 2005
6-5	Feb 25, 2005	7-23	Feb 25, 2005
6-6	Feb 25, 2005	7-24	Feb 25, 2005
6-7	Feb 25, 2005	7-25	Feb 25, 2005
6-8	Feb 25, 2005	7-26	Feb 25, 2005
6-9	Feb 25, 2005	7-27	Feb 25, 2005
6-10	Feb 25, 2005	7-28	Feb 25, 2005
6-11	Feb 25, 2005	7-29	Feb 25, 2005
6-12	Feb 25, 2005	7-30	Feb 25, 2005
6-13	Feb 25, 2005	7-31	Feb 25, 2005
6-14	Feb 25, 2005	7-32	Feb 25, 2005
7-1	Feb 25, 2005	7-33	Feb 25, 2005
7-2	Feb 25, 2005	7-34	Feb 25, 2005
7-3	Feb 25, 2005	7-35	Feb 25, 2005

PAGE	DATE	PAGE	DATE
7-36	Feb 25, 2005	8-15	Feb 25, 2005
7-37	Feb 25, 2005	8-16	Feb 25, 2005
7-38	Feb 25, 2005	8-17	Feb 25, 2005
7-39	Feb 25, 2005		
7-40	Feb 25, 2005		
7-41	Feb 25, 2005		
7-42	Feb 25, 2005		
7-43	Feb 25, 2005		
7-44	Feb 25, 2005		
7-45	Feb 25, 2005		
7-46	Feb 25, 2005		
7-48	Feb 25, 2005		
7-49	Feb 25, 2005		
7-50	Feb 25, 2005		
7-51	Feb 25, 2005		
7-52	Feb 25, 2005		
7-53	Feb 25, 2005		
7-54	Feb 25, 2005		
8-1	Feb 25, 2005		
8-2	Feb 25, 2005		
8-3	Feb 25, 2005		
8-4	Feb 25, 2005		
8-5	Feb 25, 2005		
8-6	Feb 25, 2005		
8-7	Feb 25, 2005		
8-8	Feb 25, 2005		
8-9	Feb 25, 2005		
8-10	Feb 25, 2005		
8-11	Feb 25, 2005		
8-12	Feb 25, 2005		
8-13	Feb 25, 2005		
8-14	Feb 25, 2005		

INTENTIONALLY LEFT BLANK

INTENTIONALLY LEFT BLANK

LIST OF REVISIONS

Rev. No.	Date	Page No.	Description	Approval

INTENTIONALLY LEFT BLANK

CONTENTS

SECTION 1
GENERAL

TABLE OF CONTENTS

Page

AIRCRAFT VIEWS

m (ft.)

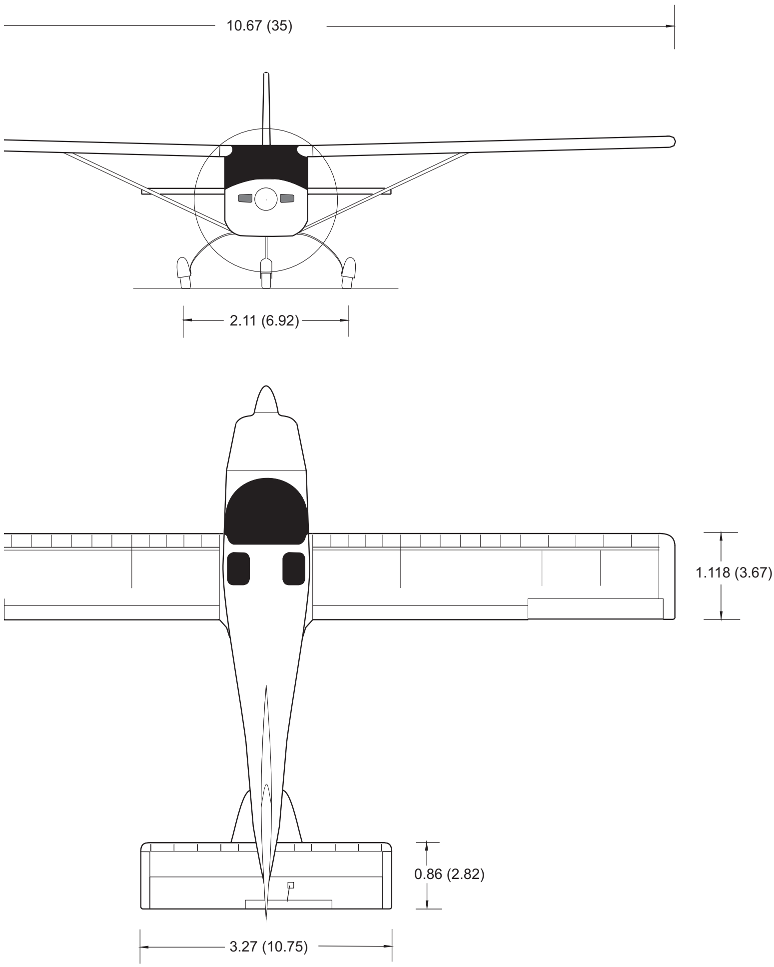
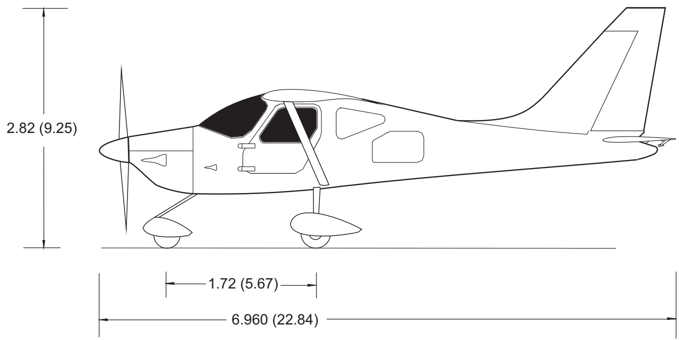


Abb. 1-1(1)
Aircraft Views



Notes:

The ground clearance of the propeller at maximum takeoff weight and in the takeoff attitude is at least 0.180 m (7 in.). Maximum propeller diameter is 1.854 m (73 in.).
The wing area is 11.93 m^2 (128.4 sq.ft.).
A minimum turning radius of 6.6 m (21.7 ft) (Pivot point to the wing tip) can be achieved.

Control Surface Deflections:
- Aileron Up 23° - Down 17°;
- Elevator Up 21° - Down 20°;
- Rudder Left 21°- Right 21°;
- Trim Tab Up 10° - Down 20°;
- Flaps - Down 0° to 40°.

Abb. 1-1(2)
Aircraft Views

1.1 INTRODUCTION

This manual constitutes a Transport Canada approved Airplane Flight Manual for Canadian registered airplanes in accordance with AWM 523.

In countries other than Canada, Transport Canada operating rules may not apply. Operators must ensure that the aircraft is operated in accordance with national operating rules.

The manual is divided into 8 sections and contains data for the pilot that must be available in accordance with the CARs. Supplementary specifications of the aircraft manufacturer are also included.

The handbook is intended to familiarize the pilot with the aircraft, operating limits, emergency procedures, normal procedures and performance.

The handbook does not serve as a substitute for appropriate flight training and knowledge of valid airworthiness advisories, the relevant official aviation rules and the advisory circulars. It is not intended as orientation for flight, basic training, or as a training manual, and it may only be used as the current status for the operation of the Aircraft.

The handbook is divided into sections, which are numbered with Arabic digits. Each section is divided by separator sheets for speedy reference. The operating limits and the emergency procedures are placed before the normal procedures, the performance data and the other sections. The section "Emergency Procedures" is marked with a red tab divider so that this section can be looked up immediately.

Provision for an extension to the handbook is provided. Therefore, some paragraph numbers, figure numbers, position numbers and pages are deliberately omitted and annotated "Intentionally left blank".

1.3 TECHNICAL DATA

Engine

(a) Number	1
(b) Engine Manufacturer	Textron Lycoming.
(c) Engine Model	O-320-D2A
(d) Engine Type	Four cylinder, direct drive, horizontally opposed, air cooled engine with a float type carburetor
(e) Rated Power	119 kW (160 BHP)
(f) Rated Speed	2700 RPM
(g) Bore	130.175 mm (5.125 in.)
(h) Stroke	98.425 mm (3.875 in.)
(i) Displacement	5.24 l (319.8 cu.in.)
(j) Compression Ratio	8.5:1

Propeller

(a) Number	1
(b) Propeller Manufacturer	MT-propeller
(c) Propeller Model	MT 186 R 140-3D P-244-3
(d) Number of Blades	2
(e) Propeller Diameter	1860 mm, (73.2)
(f) Propeller Type	Wood, fixed pitch

Fuel

(a) Fuel	Approved Fuel Grades AVGAS 100 LL blue
(b) Total Capacity	122 l (32.2 U.S. Gal)
(c) Total Usable	110 l (29.1 U.S. Gal)

Oil

(a) Oil Specification	Aviation Grade Straight Mineral Oil MIL-L-6082 and Aviation Grade Ashless Dispersant Oil MIL-L-22851

(b) Oil Viscosity

Mean Environment-Temperature	MIL-L-6082	MIL-L-22851 Ashless Dispersant
Above 16°C (60°F)	SAE 50	SAE 40 or SAE 50
-1°C (30°F) to 32°C (90°F)	SAE 40	SAE 40
-18°C (0°F) to 21°C(70°F)	SAE 30	SAE 30 or SAE 40
Below -12°C (10°F)	SAE 20	SAE 30

(c) Max. Oil Capacity	7.6 l (8 qt)
(d) Recommended Oil Quantity	4.7 - 6.6 l (5 -7 qt)

Maximum Certified Weights

(a) Maximum Ramp Weight	975 kg (2150 lbs)
(b) Maximum Takeoff Weight	975 kg (2150 lbs)
(c) Landing Weight	926 kg (2041 lbs)
(d) Maximum Weight in Baggage Compartment	75 kg (165 lbs)
but in the front or rear area maximum	45 kg (99 lbs)

Typical Aircraft Weights

(a) Empty Weight depending on installed equipment:	630 - 660 kg (1389 - 1455 lbs)
(b) Maximum Useful Load	345 kg (761 lbs)

Cabin and Entry Dimensions

(a) Maximum Cabin Width	1.10 m (43.3 in.)
(b) Maximum Cabin Length	1.22 m (48.0 in.)
(c) Maximum Cabin Height	1.14 m (44.8 in.)
(d) Maximum Entry Width	0.805 m (31.7 in.)
(e) Maximum Entry Height	0.80 m (31.5 in.)
(f) Maximum Sill Height	0.838 m (33 in.)

Baggage Spaces

(a) Compartment Width	0.44 m (17.3 in.) - 0.87 m (34.3 in.)
(b) Compartment Length	1.255 m (49.4 in.)
(c) Compartment Height	0.45 m (17.7 in.) - 0.77 m (30.3 in.)
(a) Volume	870 l (30.72 cu.ft)

Specific Loadings

(a) Wing Area Loading	81.7 kg/m^2 (16.73 lbs/sq.ft.)
(b) Power Loading	Takeoff Power (N) / 975 x 9.81 (N) = 0.122
	= 8.19 kg/kW (13.89 lbs/hp)

1.5 SYMBOLS, ABBREVIATIONS AND TERMINOLOGY

The following definitions are for symbols, abbreviation, and terms which are used in this handbook or are relevant for the pilot during the operation of the Aircraft.

(a) General Airspeed Terminology and Symbols

CAS
Calibrated Airspeed means the indicated speed of an aircraft, corrected for position and instrument error. CAS is equal to TAS in standard atmosphere at sea level.

KCAS
Calibrated Airspeed expressed in "knots”.

GS
Ground Speed is the speed relative to the ground.

IAS
Indicated Airspeed is the speed of an aircraft as shown on the airspeed indicator when corrected for instrument error. IAS values published in this Handbook assume zero instrument error.

KIAS
Indicated Airspeed expressed in "knots".

M
Mach Number is the ratio of true airspeed to the speed of the sound.

TAS
True Airspeed is the airspeed of an Aircraft relative to undisturbed air which is the CAS corrected for altitude, temperature and compressibility.

V_A / V_O
Maneuvering Speed is the maximum speed at which application of full available aerodynamic control will not overstress the Aircraft.

V_{FE}
Maximum Flap Extended Speed is the highest speed permissible with wing flaps in a prescribed extended position.

V_{NE}/M_{NE}
Never Exceed Speed or Mach Number is the speed limit that may not be exceeded at any time.

V_{NO}
Maximum Structural Cruising Speed is the speed that should not be exceeded except in smooth air and then only with caution.

V_S
Stall Speed or the minimum steady flight speed at which the Aircraft is controllable.

V_{SO}
Stall Speed with flap or the minimum steady flight speed at which the Aircraft is controllable in the landing configuration.

V_x
Best Angle-of-Climb Speed is the airspeed which delivers the greatest gain of altitude in the shortest possible horizontal distance.

V_Y
Best Rate-of-Climb Speed is the airspeed which delivers the greatest gain in altitude in the shortest possible time.

(b) Meteorological Terminology

ISA

International Standard Atmosphere in which

(1) The air is a dry perfect gas;
(2) The temperature at sea level is 15° Celsius (59° Fahrenheit);
(3) The pressure at sea level is 29.92 inches h g.(1013.2 mb);
(4) The temperature gradient from sea level to the altitude at which the temperature is -56.5°C (-69.7°F) is - 0.00198°C (- 0.003564°F) per foot and zero above that altitude.

OAT

Outside Air Temperature is the free air static temperature, obtained either from inflight temperature indications or ground meteorological sources, adjusted for instrument error and compressibility effects.

MSN

Mean Sea Level

Indicated Pressure Altitude

The number actually read from an altimeter when the barometric subscale has been set to 29.92 inches of mercury (1013.2 mb).

Pressure Altitude

Altitude measured from standard sea level pressure (29.92 in. hg.) by a pressure or barometric altimeter. It is the indicated pressure altitude corrected for position and instrument error. In this Handbook, altimeter instrument errors are assumed to be zero.

Station Pressure

Actual air pressure at field elevation.

(c) Power Terminology

Takeoff Power
The maximum power permissible for takeoff (may be time limited).

Maximum Continuous Power
Highest power setting, not limited by time.

Cruise Climb Power
Power recommended for cruise climb.

Maximum Cruise Power
The maximum power setting for which specific values of fuel flow and airspeed are presented.

(d) Engine Instruments

EGT-Indicator
Exhaust Gas Temperature Indicator

CHT-Indicator
Cylinder Heat Temperature Indicator

(e) Aircraft Performance and Flight Planning Terminology

Climb Gradient
The demonstrated ratio of the change in height during a portion of a climb, to the horizontal distance traversed in the same time interval

Demonstrated Crosswind Velocity

The demonstrated crosswind velocity is the velocity of the crosswind component for which adequate control of the Aircraft during takeoff and landing was actually demonstrated during certification tests.

Accelerate-Stop Distance

The distance required to accelerate an Aircraft to a specified speed and, assuming failure of an engine at the instant that speed is attained, to bring the Aircraft to a stop.

Route Segment

A part of a route. Each end of that part is identified by: (1) a geographical location; or (2) a point at which a definite radio fix can be established.

MEA

Minimum enroute IFR altitude.

(f) Weight and Balance

Reference Datum

An imaginary vertical plane from which all horizontal distances are measured for balance purposes.

Station

A location along the Aircraft fuselage usually given in terms of distance from the reference datum.

Arm

The horizontal distance from the reference datum to the center of gravity (C.G.) of an item.

Moment
The product of the weight of an item multiplied by its arm. (Moment divided by a constant is used to simplify balance calculations by reducing the number of digits.)

Center of gravity (C.G.)
The point at which an Aircraft would balance if suspended. Its distance from the reference datum is found by dividing the total moment by the total weight of the Aircraft.

C.G. Arm
The arm obtained by adding the Aircraft's individual moments and dividing the sum by the total weight.

C.G. Limits
The extreme center of gravity locations within which the Aircraft must be operated at a given weight.

Usable Fuel
Fuel available for flight planning purposes.

Unusable Fuel
Fuel remaining after a run out test has been completed in accordance with governmental regulations.

Standard Empty Weight
Weight of a standard Aircraft including unusable fuel, full operating fluids and full oil.

Basic Empty Weight
Standard empty weight plus optional equipment.

Useful load
Difference between take off weight, or ramp weight if applicable, and basic empty weight.

Payload
Weight of occupants, cargo and baggage.

Maximum Ramp Weight
Maximum weight approved for ground maneuvre. (It includes weight of start, taxi and run up fuel.)

Maximum Takeoff Weight
Maximum weight approved for the start of the takeoff run.

Maximum Landing Weight
Maximum weight approved for the landing touchdown.

Maximum Zero Fuel Weight
Maximum weight exclusive of usable fuel.

(g) Other Definitions

WARNING !

Methods, procedures or limits which must be followed precisely to avoid injury or death.

CAUTION !

Methods, procedures or limits which must be followed to avoid damage to equipment.

NOTE:
Additional procedures or information pertaining to the text.

SECTION 2
LIMITATIONS

TABLE OF CONTENTS

2.1 GENERAL

This section contains the operating limits (approved by the regulatory authority), the instrument markings, the color coding and the most important placards that are necessary for the safe operation of the aircraft, engine, systems, and the aircraft's standard equipment.

The Chapter 4 "Airworthiness" of the SA 160 Maintenance Manual contains the prescribed limitations concerning the maintenance.

The aircraft must be operated in compliance with these operating limits, which are provided in the form of markings and placards as well as in this manual.
Operating limits for specific systems and equipment are incorporated in section 9, entitled "Supplements".

2.3 AIRSPEED LIMITATIONS

Airspeed	**KIAS**	**KCAS**
$\mathbf{V}_{NE}$ - Do not exceed this speed in any operation.	162	162
Maximum Structural Cruising Speed $\mathbf{V}_{NO}$ - Do not exceed this speed except in smooth air and then only with caution.	130	130
Maneuvering Speed $\mathbf{V}_{A}$ / $\mathbf{V}_{O}$ at weight 975 kg (2150 lbs). Do not make full or abrupt control movements above this speed.	116	116

Airspeed	KIAS	KCAS
Maximum Flap Extended Speed **V_{FE}**, Flap setting 20° and 40° - Do not exceed this speed with flaps down.	90	89
Stalling Speed **V_S** - Minimum steady flight speed at which the aircraft is controllable.	60	59
Stalling Speed **V_{SO}** - Minimum steady flight speed at which the aircraft is controllable in the landing configuration.	51	50

WARNING !

The maneuvering speed decreases at lighter weight as the effects of aerodynamic forces become more pronounced.
Linear interpolation may be used for intermediate gross weights.
Maneuvering speed should not be exceeded while operating in rough air.

2.5 AIRSPEED INDICATOR MARKINGS

Markings	KIAS	Remarks
Red Line	162	Never exceed speed. Maximum speed for all operations.
Yellow Arc	130 - 162	Operations must be conducted with caution and only in smooth air.

Markings	KIAS	Remarks
Green Arc	60 - 130	Normal Operating Range
White Arc	51 - 90	Full Flap Operating Range

2.7 POWER PLANT LIMITATIONS

(a) Number of Engines	1
(b) Engine Manufacturer	Textron Lycoming
(c) Engine Model Number	O-320 D2A
(d) Engine Operating Limits	
(1) Maximum Takeoff Power	119 kW (160 BHP)
(2) Maximum Engine Speed	2700 RPM
(3) Maximum Oil Temperature	245 °F (118°C)
(e) Oil Pressure	
Minimum Oil Pressure (Red Line)	25 psi
Maximum Oil Pressure (Red Line)	97 psi
(f) Fuel Pressure	
Minimum Pressure (Red Line)	0.5 psi
Maximum Pressure (Red Line)	8 psi
(g) Fuel grade (minimum requirement) only aviation fuel	AVGAS 100LL
(h) Oil grades (minimum requirement)	aviation oils (see section 8, para. 8.11)
(h) Number of Propellers	1
(i) Propeller Manufacturer	MT-Propeller
(j) Propeller Model	MT 186 R 140-3D
(k) Propeller Diameter	1.854 m (73 in.)
(l) Static RPM at Maximum Takeoff Power	2700 RPM

2.9 ENGINE PARAMETER COLOR MARKINGS

ENGINE PARAMETER COLOR MARKINGS ON THE VM 1000 INDICATOR

Parameter	LOW RED ARC (PROHIBITED)	LOW YELLOW ARC (CAUTION!)	GREEN ARC (NORMAL OPERATING RANGE)	UPPER YELLOW ARC (CAUTION!)	UPPER RED ARC (PROHIBITED)
RPM ~ U / MIN	—	—	0600 - 2700	—	2701
MAN PRES ~ HG	—	—	13.0 - 29.0	29.1 - 31.0	31.1
OIL PRES ~ PSI	0 - 24	25 - 54	55 - 95	96 - 97	98
OIL TEMP ~ °F	—	—	75 - 245	—	246
FUEL FLOW ~ GPH	—	—	2 -16	17 - 18	19
FUEL PRES ~ PSI	—	—	0.5 - 8.0	—	8.1
CHT ~ °F	—	—	150 - 435	436 - 500	501
EGT ~ °F	—	—	1300 -1550	—	—
VOLTS ~ V	—	—	24.0 - 28.7	28.8 - 31.9	32.0
AMPS ~ A	—	—	1 - 50	—	—

2.11 WEIGHT LIMITS

(a) Maximum Ramp Weight:	975 kg (2150 lbs)
(b) Maximum Takeoff Weight:	975 kg (2150 lbs)
(c) Maximum Landing Weight	926 kg (2042 lbs)
(d) Maximum Weight in Baggage Compartment	75 kg (165 lbs)
but in the front or rear area maximum	45 kg (99 lbs)

NOTE: For dependence maximum weights on performance see section 5, “Performance”.

2.13 CENTER OF GRAVITY LIMITS

Weight kg /lbs	Forward (m / in. aft of Datum.)	Aft (m / in. aft of Datum)
648 / 1428	2.45 / 96.46	-
975 / 2150	-	2.60 / 102.36

NOTE: Changes between the specified points are linear. The reference datum is 1.5367 m (60.5 in.) in front of the firewall. Statements for correct loading see also in section 6, “Weight and Balance".

2.15 MANEUVER LIMITS

All aerobatics maneuvers including spins are prohibited.
The aircraft is authorized for maneuvers in which the angle off bank is not more than 60°.

2.17 FLIGHT LOAD FACTOR LIMITS

Configuration	Maximum Flight Load Factor
Flaps Up	3.80 / -1.5
Flaps Down	2.00

Maneuvers with a negative flight load factor are prohibited.

2.19 CREW

(a)	Minimum Crew VFR	1 Pilot
(b)	Minimum Crew IFR	1 Pilot* (FAA registered Aircraft)
(c)	Max. Persons on Board	2

* Pilots operating aircraft of other than U.S. registry should refer to the appropriate regulations of the country of certification.

2.21 KINDS OF OPERATIONS

The aircraft is certified for VFR Day /Night and IFR operations as long as the equipment required by FAR Part 91 is installed and operational.

Flight into known or forecast icing conditions is prohibited.

The reference to types of flight operations on the operating limitation placard reflects equipment installed at the time of Airworthiness Certificate issuance.

2.23 FUEL LIMITATIONS

(a) Total Fuel:	122 l	(32.2 U.S. Gallons)
(b) Usable Fuel:	110 l	(29.1 U.S. Gallons)
(c) Unusable Fuel:	12 l	(3.1 U.S. Gallons)

Additional Fuel Limitations:

(a) With less than 12 liters (3 U.S. Gallons) per each wing tank (Indicator shows “Lo”) power on descents with flaps fully extended must be limited to maximum 10 minutes duration.

2.25 OTHER LIMITATIONS

(a) Airframe

For safe aircraft operation all four Vortex Generators (Refer to Section 7, 7.3 Aircraft) must be in place and in good condition.

WARNING !

Absence of one or several Vortex Generators affects the flight behavior of the aircraft unfavorably when close to the stall speed.

2.27 TEMPERATURE LIMITATION

(a) OAT for Operating (Avionics) -20/+50°C

2.29 PLACARDS

The following placards must be attached inboard and outboard of the aircraft in the required places.

1. In full view of the pilot:

WITH FUEL BELOW 12 LITERS (3 U.S. GAL.) IN EACH WING TANK ("Lo" IND.), POWER ON DESCENTS WITH FLAPS DOWN ARE LIMITED TO 10 MINUTES MAX DURATION.
(SEE POH)

OPERATING MODE: NORMAL CATEGORY
FOR FLIGHTS IN VFR, DAY AND NIGHT CERTIFIED
FLIGHTS INTO KNOWN ICING CONDITIONS ARE PROHIBITED!
FLIGHTS IN HEAVY TURBULENT AIR AND
CLOSE TO THUNDERSTORMS ARE PROHIBITED!
SEE THE LIMITATION SECTION IN THE POH

MAXIMUM GROSS WEIGHT:		2150 [lbs]
MAXIMUM LANDING WEIGHT:		2042 [lbs]
MANEUVERING SPEED:		116 [kts]
MAX. FLAP EXTENDED SPEED:		90 [kts]
MAX. DEMONSTRATED CROSSWIND		
COMPONENT:	TAKEOFF	20 [kts]
	LANDING	17 [kts]

For VFR equipped aircraft only.

OPERATING MODE: NORMAL CATEGORY
FOR FLIGHTS IN VFR, IFR, DAY AND NIGHT CERTIFIED
FLIGHTS INTO KNOWN ICING CONDITIONS ARE PROHIBITED!
FLIGHTS IN HEAVY TURBULENT AIR AND
CLOSE TO THUNDERSTORMS ARE PROHIBITED!
SEE THE LIMITATION SECTION IN THE POH

MAXIMUM GROSS WEIGHT:		2150 [lbs]
MAXIMUM LANDING WEIGHT:		2042 [lbs]
MANEUVERING SPEED:		116 [kts]
MAX. FLAP EXTENDED SPEED:		90 [kts]
MAX. DEMONSTRATED CROSSWIND		
COMPONENT:	TAKEOFF	20 [kts]
	LANDING	17 [kts]

For IFR equipped aircraft only.

NO SMOKING

THE AIRCRAFT MUST BE OPERATED IN COMPLIANCE WITH THE PILOT'S OPERATING HANDBOOK

ACROBATIC MANEUVERS, INCLUDING SPINS, ARE NOT APPROVED

2. Near oil access door

ENGINE OIL

ABOVE 16°C (60°F)	SAE 40 OR SAE 50
-1°C (30°F) TO 32°C (90°F)	SAE 40
-18°C (0°F) TO 21°C (70°F)	SAE 30 OR SAE 40
BELOW -12°C (10°F)	SAE 30

USE ONLY OIL THAT COMPLIES WITH APPLICABLE
PILOT'S OPERATING HANDBOOK

3. Left fuselage, near the engine cowling

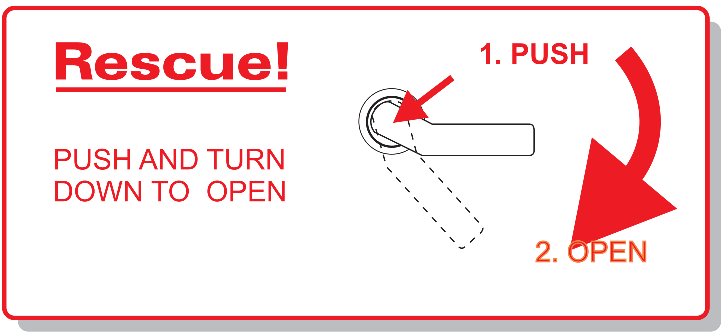
Symphony Aircraft Industries
Trois-Rivieres-Québec
Canada

MODEL	TYPE CERTIFICATE
SA 160	A 229
MANUFACTURED	SERIAL NO.
0X/200X	S-XXXX

4. On the left fuselage side below the horizontal stabilizer

**AIRCRAFT DATA PLATE
LOCATED AT FIREWALL
THIS SIDE!**

5. On the doors below the door handle



6. On the baggage door

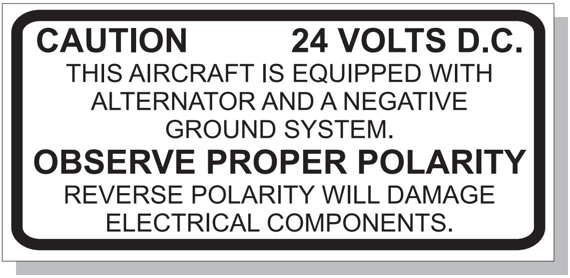
99 LBS MAXIMUM
BAGGAGE FORWARD OF RED MARKING

99 LBS MAXIMUM
BAGGAGE AFT OF RED MARKING

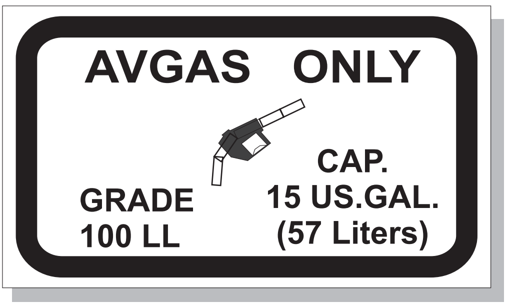
MAXIMUM 165 LBS COMBINED

SEE WEIGHT AND BALANCE DATA

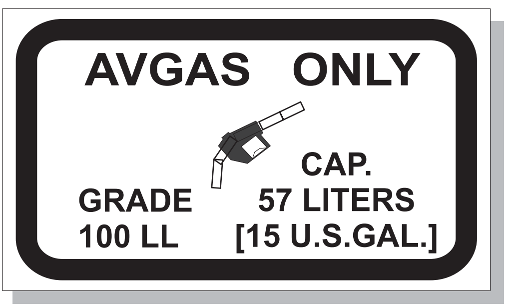
7. Near external power receptacle



8. Near fuel tank filler cap



For aircraft registered in countries where imperial units are used.



For aircraft registered in countries where SI units are used.

SECTION 3

EMERGENCY PROCEDURES

TABLE OF CONTENTS

Page

TABLE OF CONTENTS (Continued)

3.1 GENERAL

This section contains the recommended procedures for coping with various emergencies or critical situations as required by the Aviation Authorities, as well as those necessary for operation of the aircraft, as determined by the operating and design features of the aircraft.
Emergency procedures associated with optional systems and equipment, which require handbook supplements, are presented in Section 9, "Supplements".
This section is divided into two main parts:

1) The first part contains the emergency procedure checklists. These checklists are clearly arranged to give an action sequence to be followed during given situations without explanations.

2) The second part provides amplified emergency procedures corresponding to the emergency procedures checklist items. These amplified emergency procedures contain additional information to

provide the pilot with a more complete description of the procedures and a better understanding of the reasons for the actions listed.
The numbers located in parentheses () after each paragraph heading indicate the corresponding checklist paragraph.

It is recommended that pilots familiarize themselves with the emergency procedures described in this section and review them periodically. This process helps ensure pilots take the appropriate action should an emergency situation arise.
These procedures are offered as a course of action for coping with a given situation or condition. <u>They are not a substitute for sound judgment, good airmanship and common sense</u>.

Standard Emergency Procedures are a part of pilot training. The information given here does not replace this education. They provide a source of reference for the procedures that are applicable to this aircraft.

3.3 AIRSPEEDS FOR EMERGENCY OPERATIONS

(a) Stalling Speeds
975 kg (2150 lbs) Flaps Up ....60 KIAS
975 kg (2150 lbs), Flaps Full Down...51 KIAS

(b) Maneuvering Speeds
975 kg (2150 lbs) ....116 KIAS

(c) Never Exceed Speed ....162 KIAS

(d) Speed For Maximum Gliding
Distance Without Engine Power
i) Flaps Up..74 KIAS
ii) Flaps 20°...65 KIAS

Gliding at the above speeds will result in 1.6 NM of gliding distance per 1000 ft for both flight configurations.

3.5 EMERGENCY PROCEDURES CHECKLIST

(a) Engine Failure During Takeoff Roll

1. Throttle ....IDLE
2. Apply brakes and hold direction. Avoid obstructions, if possible:
3. Flaps ....RETRACT
4. Mixture ....IDLE CUT-OFF
5. Ignition Switch ....OFF
6. Switch ALT / BAT ....OFF

(b) Engine Failure Immediately After Takeoff

1. Establish glide,
   Airspeed with Flaps down ....65 KIAS
   Airspeed with Flaps up ....74 KIAS
2. Land straight ahead, make only shallow turn to avoid obstructions, if possible:
3. Mixture ....IDLE CUT-OFF
4. Fuel Valve ....OFF
5. Ignition Switch ....OFF
6. Switch ALT / BAT ....OFF

(c) Engine Failure During Flight (Restart Procedures)

1. Establish glide - secure airspeed of 74 KIAS. Locate suitable field. At sufficient flight altitude:
2. Mixture ....CHECK FULL RICH
3. Aux. Fuel Pump ....ON
4. Carburetor Heat ....ON
5. Ignition Switch ....“BOTH“

6. Fuel Valve ....CHECK ON
7. Fuel Quantity ....CHECK
8. Engine Parameters...CHECK
9. If propeller is stopped (V<70 KIAS):
   Ignition switch shortly ....“START“
   to initiate autorotation.

If power is not restored, prepare for ➤ Landing Without Engine Power (d).

(d) Landing Without Engine Power

1. Airspeed ....74 KIAS
2. Seat Belts and Harnesses...TIGHT
3. Flaps ....as required SET
   Before landing:
4. Mixture ....IDLE CUT-OFF
5. Fuel Valve ....OFF
6. Ignition Switch ....OFF
7. Switch ALT / BAT...OFF
   Touchdown with lowest possible airspeed
8. Doors...............................UNLATCH PRIOR TO TOUCHDOWN
9. Brakes as required ....APPLY

(e) Rough Engine Operation

1. Carburetor Heat...ON
2. Aux. Fuel Pump ....ON
3. Mixture ....ADJUST for MAXIMUM SMOOTHNESS
4. Primer ....CHECK LOCKED
5. Ignition Switch ....L then R; then BOTH
   If operation is satisfactory on either magneto, continue on that magneto to first suitable airfield.
7. Engine Parameters...CHECK
   If roughness continues for some minutes and atmospheric conditions make carburetor icing unlikely:
8. Carburetor Heat ....OFF

(f) Precautionary Landing With Engine Power

1. Locate suitable field. Test suitability of the field with overflight.
2. If radio contact is available, inform the corresponding ground station about intentions and location.
3. Prepare for landing approach. In final turn:
4. Airspeed ....65 KIAS
5. Flaps ....40°
6. Seat Belts and Harnesses..TIGHT
   Before landing:
7. Switch ALT / BAT..OFF
8. Cabin Doors........................UNLATCH PRIOR TO TOUCHDOWN
9. After touchdown with lowest possible airspeed, apply brakes and attempt to avoid obstructions, if possible:
10. Mixture ....IDLE CUT-OFF
11. Ignition Switch ....OFF
12. Fuel Valve ....OFF

(g) Ditching

After an engine failure immediately secure glide speed 74 KIAS, trim aircraft. When the mainland can't be reached:

1. Transmit Mayday message giving location and intentions, set Squawk 7700 (or as directed by TC)
   Perform approach into the wind if strong winds and heavy seas, otherwise parallel to swells.
2. Seat Belts and Harnesses..TIGHT
3. ELT ....ACTIVATE
4. Flaps (65 KIAS) ....40°
5. Cabin Doors......................UNLATCH PRIOR TO TOUCHDOWN
6 Touchdown on water surface should be made at lowest possible airspeed with maximum angle off attack.
7. Aircraft ....EVACUATE
8. Inflate Life Vests and Raft when clear of aircraft.

(h) Engine Fire During Engine Start

1. Ignition Switch..CRANK ENGINE

If engine starts:

2. Keep throttle for a few minutes at....................................1800 RPM
3. Engine ....SHUTDOWN
and inspect for damage.

If engine fails to start:

4. Ignition Switch.........................CONTINUE CRANKING ENGINE

5. Throttle ....FULL OPEN
6. Mixture ....IDLE CUT-OFF
7. Fuel Valve ....OFF

If fire continues

8. "ALT / BAT" ....OFF
9. Fire Extinguisher ....USE
10. Aircraft ....EVACUATE

(i) Engine Fire In Flight

1. Fuel Valve ....OFF
2. Throttle...CLOSED
3. Mixture ....IDLE CUT-OFF
4. Aux. Fuel Pump ....OFF
5. Cabin Heat..OFF
6. Cabin Ventilation for Lowest
Smoke in Cabin ....SET
Inform the corresponding ground station
7. "ALT / BAT" ....OFF
8. Fire Extinguisher as required...ACTIVATE
Proceed with ➤ Landing Without Engine Power(d)

(j) Electrical Fire In Flight

1. Switch ALT / BAT .... OFF
2. Cabin Ventilation .... CLOSED
3. Cabin Heat .... OFF
4. Fire Extinguisher as required .... ACTIVATE
5. All other Switches
   (except ignition switch) .... OFF

WARNING !

After fire is completely extinguished, ventilate cabin.
If it cannot be visually determined that the fire is completely extinguished, land as soon as possible.

After ascertaining that fire has been extinguished completely:

6. Cabin ventilation .... FULL OPEN
7. Switch ALT / BAT .... ON
8. Circuit Breakers .... CHECK
   If the short circuit is localized:
9. Required electrics .... ON
10. Land as soon as practical to inspect damages.

(k) Loss Of Oil Pressure

Land as soon as possible.
Oil Temperature .... CHECK
Prepare for ▶ Landing Without Engine Power (d).

(l) Power Supply System Malfunction

Ammeter and voltmeter shows a power supply system malfunction.

1. “ALT“ Switch ....CHECK ON
2. ALT FLD circuit breaker...CHECK
   and reset as required.
3. “ALT“ Switch ....OFF then ON
   If power of alternator is not restored:
4. “ALT“ Switch...OFF
5. Non-essential electrical equipment..OFF
6. Land as soon as practical.

(m) Excessive Rate Of Charge

Ammeter and voltmeter shows a excessive rate of charge.

1. “ALT“ Switch ....OFF
2. Non-essential electrical equipment..OFF
3. Land as soon as practical.

(n) Icing

Watch for signs of icing conditions, immediately leave the region in which the icing occurred. If possible, change flight altitude.

(o) Flap Actuator Drive Failure

“Flap in Motion” light stay ¨on¨ when the flaps are fully retracted or extended.

1. FLAPS circuit breaker ....PULL
2. Land as soon as practical.

WARNING !

Icing has a very strong negative effect on the aerodynamic characteristics of the aircraft. Stalling speed increases.
Continued flight in icing conditions is prohibited.

1. Pitot Heat Switch..ON
2. Carburetor Heat...ON
3. Cabin Heat / Ventilation ....ON
   Land at the nearest airfield.
4. Wind shield Heat ....ON

With an ice accumulation of 5mm ore more on the wing leading edges, perform landing with flaps retracted or in 20° position. Airspeed in final approach must be higher corresponding the ice accumulation and the flap position.

(p) Static Source Blockage (IFR)

1. Alternate Static Source ....OPEN
2. Airspeed ....ADJUST
   According to the Airspeed Calibration
   (Alternate Static Source) table in Section 5. P.5.11

(q) Spin Recovery Procedure

1. Throttle ....IDLE
2. Ailerons ....NEUTRAL
3. Rudder ....FULL OPPOSITE TO DIRECTION OF ROTATION
   At the same time
4. Elevator ....NEUTRAL
5. Rudder (when rotation stops) ....NEUTRAL
   As rotation stops make a smooth recovery from the dive. If flaps were extended, retract and establish horizontal flight with engine power as required.

3.7 AMPLIFIED EMERGENCY PROCEDURES

Engine Failure During Takeoff Roll ➤ Checklist 3.5 a

If loss of power occurs during takeoff roll, the aircraft must be brought to a halt as soon as possible in order to avoid leaving the runway. Engine power must be reduced to idle.
It is recommended that flaps be retracted in order to reduce lift force. This increases the rolling friction and therefore decreases the accelerate-stop distance.
If the aircraft goes off the runway, damage (possible collision with obstacles and even overturning) cannot be excluded. Seat belts and harnesses must be tight to reduce the possibility of injury.
In order to reduce the danger of a short circuit and /or fire, the fuel supply to the engine should be cut off and the electrical system turned off. Cut off the fuel supply by moving the Mixture control to the position IDLE CUT-OFF. Turn off the ALT / BAT switch and the ignition switch.

Engine Failure Immediately After Takeoff ➤ Checklist 3.5 b

In climbing flight without engine power, the aircraft will lose airspeed very quickly. In order to guarantee further controllability the control stick must be moved forward to establish a glide attitude.
Avoid obstacles and avoid steep angles of bank.

WARNING !

At no time should the airspeed decrease below the stalling speed for the configuration setting. Note: This speed increases by increasing the angle of bank of the aircraft. See section 5 Fig. 5-5 "Stalling Speed".

When performing an off field landing, damage (possible collision with obstacles and even overturning) cannot be excluded. Seat belts and harnesses must be tight to reduce the possibility of injury.
In order to reduce the danger of a short circuit and /or fire, the fuel supply to the engine should cut off and the electrical system turned off. Cut off the fuel supply by moving the Mixture control to the position IDLE CUT-OFF and the fuel valve to OFF. Turn off the ALT / BAT switch and the ignition switch.
Touchdown should be made at the lowest possible airspeed.

Engine Failure During Flight (Restart Procedures)

➤ Checklist 3.5 c

Sudden and complete engine power loss is usually the result of fuel flow interruption. Power should be restored shortly after fuel flow is restored.
If power loss occurs at low altitude, the first step is to prepare for an emergency landing. Promptly establish a glide attitude and secure the speed for best gliding angle (74 KIAS). Trim the aircraft and look for a field suitable for landing.
If altitude permits, move the mixture control to RICH and check the auxiliary fuel pump and, if required, switch to ON. It supports the fuel supply to the engine if the engine driven fuel pump has failed. Switch the carburetor heat to ON. Check to ensure the ignition switch is in "BOTH" position.

WARNING !

At airspeeds below 75 KIAS the propeller can stop (no autorotation).

In this event increase the airspeed to autorotation or turn ignition

switch to START to start the engine.
Check the fuel valve is in ON position, and the fuel quantity in the wing tanks is sufficient. By examining the engine parameters, it is usually possible to determine the cause of the power loss and rectify the situation.
As soon as the engine power is restored, and if the failure cause was not carburetor icing, move the carburetor heat to the OFF position.
If power is not regained, proceed with the “Landing Without Engine

Landing Without Engine Power ➤ Checklist 3.5 d

The gliding air speed of 74 KIAS (flaps up) and 65 KIAS (flaps 20°) delivers minimum loss of altitude in a given time. Over a distance of 1.6 NM the loss of altitude is 1000 ft.
With sufficient altitude and after selection of a suitable field, a spiral pattern should be attempted around the selected field. In this way, a series of correction possibilities are available in order to complete a precise landing at the chosen point without engine power.
While descending, if radio contact is available, notify the corresponding ground station of your difficulty, location and intentions. Excess altitude may be lost by widening the pattern, using flaps, side-slipping, or a combination of these.

WARNING !

At no time should the airspeed reduce below the stalling speed for the configuration setting. Note: This speed increases by increasing the angle of bank of the aircraft. See section 5, Fig. 5-4 “Stalling Speed“.

In order to contact the ground at the lowest possible speed, flaps should be full extended just before landing and the speed should be 65 KIAS.

While perform a forced landing on unknown field, damage (possible collision with obstacles and even overturning) cannot be excluded. Seat belts and harnesses must be tight to reduce the possibility of injury.
In order to reduce the danger of a short circuit and /or fire, the fuel supply to the engine should cut off and the electrical system turned off. Cut off the fuel supply by moving the Mixture control to the position IDLE CUT-OFF and the fuel valve to OFF. Turn off the ALT / BAT switch and the ignition switch.

Rough Engine Operation ➤ Checklist 3.5 e

Rough engine operation can be caused by various problems.
In the case of carburetor icing, turn carburetor heat ON. Wait for a decrease in engine roughness or an increase in RPM, indicating ice removal. If carburetor heat shows no effect, and atmospheric conditions make carburetor icing unlikely (if CAT indicator installed, check reading), after some minutes turn carburetor heat OFF. Check the fuel valve is in ON position.
The auxiliary fuel pump supports the fuel supply to engine if the engine driven fuel pump does not work correctly.
Check the mixture control lever position, adjust for maximum smoothness. A unlocked primer may also cause for engine roughness.
Switching from BOTH to either L or R ignition switch position will identify a magneto or a spark plug problem.
Check the VM 1000 display for abnormal readings that may indicate the cause.

Precautionary Landing With Engine Power ➤ Checklist 3.5 f

A precautionary landing with engine power usually offers sufficient time reserve to take all the necessary measures to minimize the danger. The choice of the field should be made considering size, surface conditions, vegetation, any obstructions in the planned

approach direction and the current wind direction. A fly-over provides the opportunity for a better assessment of the selected field. A ground station by radio should if possible, be informed of the decision for precautionary landing and the location.
It is recommended to make a landing approach from the downwind leg above the field. This procedure provides enough time and correction possibilities for a precise approach. On final approach the normal speed and flap settings should be taken.
Perform a landing on an non-prepared field, any damage (possible collision with obstacles or overturn) can not be excluded. Seat belts and harnesses set up tightly reduce the injury hazard.
When committed to a landing, turn OFF the ALT / BAT switch before touchdown and unlatch both doors before touch down. After touchdown at the lowest possible airspeed, attempt to brake the aircraft as soon as possible. Stop the engine with mixture control and Ignition Switch. Then, closing the fuel valve, interrupt the fuel supply.

Ditching ▶ Checklist 3.5 g

During a landing in water, tighten seat belts to reduce the risk of injury. Brief passenger, if any, on the opening mechanism of the seat belts before touchdown.Unlatch door before touchdown.
Touchdown on the water surface with minimum possible airspeed and maximum angle of attack. Evacuate aircraft, inflate life vests and raft when clear of aircraft.

Engine Fire During Engine Start ▶ Checklist 3.5 h

Engine fires during engine start are usually the result of over priming. In such a case, the first effort to extinguish the fire should be to

attempt an engine start in order to draw the excess fuel back into the induction system. If the engine starts, with higher RPM there is a good chance to blow out a possible external fire. If the engine fails to start, try to draw the fire back into the engine by moving the mixture control to IDLE CUT-OFF, opening the throttle, turning OFF the fuel valve, while cranking the engine.
If is not possible to extinguish the fire, turn OFF the ALT / BAT switch, use the fire extinguisher, evacuate the aircraft.

Engine Fire In Flight ➤ Checklist 3.5 i

If an engine fire clearly exists, shut off the fuel supply to the engine by closing the fuel valve. Then, stop the engine with the throttle, the mixture control and the ignition switch. Turn OFF the auxiliary fuel pump.
In order to avoid smoke reaching the cabin, check cabin heat is off. If smoke enters the cabin via cabin ventilation, close it. After information of the corresponding ground station about the situation, turn OFF ALT / BAT switch. Proceed with the ➤ "Landing Without Engine Power" procedure (Checklist 3.5 d).

Electrical Fire In Flight ➤ Checklist 3.5 j

If smoke and/or fumes are experienced in the cabin, this may indicate a cable fire, the whole electrical system of the aircraft should be switched off to prevent spreading of any fire: With the exception of the ignition, turn all electrical equipment and the ALT / BAT switch OFF.
Turn the cabin heat OFF and close the cabin ventilation to avoid smoke ingress into the cabin.
After discharging fire extinguisher ascertain that the fire has been extinguished. Then ventilate the cabin sufficiently.

WARNING !

Residual smoke in the cabin can cause feeling of sickness and of nausea. Therefore, ventilate cabin fully and make a precautionary emergency landing.

Pop all circuit breakers and set ALT / BAT switch ON. Then set circuit breakers one by one for required electrics and to localize a possible short circuit.

Loss of Oil Pressure ➤ Checklist 3.5 k

Loss of oil pressure may be either partial or complete. A partial loss of oil pressure usually indicates a malfunction in the oil pressure regulating system of the engine. However, an oil loss and/or defect of the oil pump is also possible. In either case, a landing should be made as soon as possible to investigate the cause and to prevent engine damage.
A complete loss of oil pressure indication may be the result of a faulty gauge, a total oil pump failure, or may signify oil exhaustion.
Immediately proceed toward the nearest airfield, and be prepared for the engine to stop suddenly. Avoid unnecessary loads on the engine. Flight altitude should be maintained. Pay particular attention to the oil temperature.
Depending on the circumstances, it may be advisable to make a off field landing while power is still available, particularly if other indications of actual oil pressure loss, such as sudden increase in temperatures, or oil smoke, or oil on the windshield, are apparent, and an airfield is not close.
If an engine stoppage occurs, proceed with ➤ "Landing Without Engine Power" (Checklist 3.5 d)

Power Supply System Malfunction ➤ Checklist 3.5 l

Loss of alternator output can be detected by monitoring the ammeter and the voltmeter on the VM 1000 indicator.
Verify the "ALT" switch is on. Check the ALT FLD circuit breaker and reset if required.
Attempt to reset the over voltage protection system of the alternator regulator by turning "ALT" OFF and then ON. Check the ammeter and voltmeter.
If the alternator will not reset, turn OFF the ALT switch and reduce the electrical load to a minimum. All electrical load is now being supplied by the battery. Turn off all non-essential electrical equipment.
Proceed toward nearest airfield.

NOTE: A power supply malfunction has no effect of the engine operation.

Excessive Rate Of Charge ➤ Checklist 3.5 m

With a faulty alternator regulator an excessive rate of charge and an overcharging of the battery may occur.
Electrical equipment may be damaged by over voltage.
If ammeter and voltmeter on the VM 1000 indicator indicates an excessive rate of charge, turn OFF the Alternator by the switch ALT.
Turn off non-essential electrical equipment, to decreases the battery discharge. In such case all electrical load is being supplied by the battery. Terminate flight as soon as practical.

➤

Icing ▶ Checklist 3.5 n

Under certain circumstances, usually in cold weather, icing conditions may prevail and ice can accumulate on external surfaces of the aircraft. The occurrence and the manner of icing depends on the air temperature, humidity, as well as other atmospherically condition but also on the airspeed of the aircraft.
At the first sign of icing conditions the area of icing should be left as soon as possible.

WARNING !

Icing has a very strong negative effect on the aerodynamic characteristics of the aircraft. Stalling speed increases.
Continued flight in icing conditions is prohibited.

A change of temperature will occur with a change of altitude.
The pitot heat reduces the chance of ice accumulation on the pitot tube, which could cause wrong indications and failure of the static / dynamic system.
The carburetor is especially at risk because of the rapid absorption of heat from the air by vaporization of the fuel. To prevent carburetor icing and an engine power loss, switch carburetor heat ON. Cabin heating and cabin ventilation prevents icing on the windshield.
It is advisable to proceed toward the nearest airfield and wait for better weather conditions.
With an ice accumulation on the wing leading edges of 5mm or more, perform a landing with flaps up or in 20° position.
The landing approach speed should be higher depending upon amount of the accumulation.

Static Source Blockage (IFR) ➤ Checklist 3.5

If erroneous readings of the static source instruments (aispeed, altimeter and vertical speed) are suspected, the alternate static source valve, on the left side of instrument panel, should be opened to supply static pressure from the cabin to these instruments. With the alternate static source on, adjust indicated airspeed slightly during climb or approach according to the Airspeed Calibration (Alternate Static Source) table in section 5 as page 5.11 appropriate for vent configuration, causing the aircraft to be flown within the normal operating speed limits.

Spin Recovery Procedure ➤ Checklist 3.5 p

WARNING !

Intentional spins in the SA 160 are prohibited.

Cause of inadvertent spins is usually the result of heavy or insensitive control inputs. The spin recovery is unproblematic with the SA 160.

Once the spin is recognized: first move the throttle to idle and the ailerons to neutral. Stop the rotation of the aircraft by applying the rudder full opposite to the direction of yaw. At the same time move the control stick forward up until the elevator is approx. in neutral position, to reduce the angle of attack to sub critical values.
When the rotation stops, neutralize the rudder and make a smooth recovery from the resulting dive increasing engine power as required.
If flaps were down retract as soon as rotation is stopped.

NOTE: For spin recovery move the ailerons in neutral position and

check this by means of control stick position to the panel. Different aileron forces cause an incorrect neutral position and may delay the spin recovery.

The maximum altitude loss for a 1-turn spin is 300 ft. 1000 ft may required to accomplishing both, the spin recovery and the dive

SECTION 4

NORMAL PROCEDURES

TABLE OF CONTENTS

Page

TABLE OF CONTENTS (Continued)

4.1 GENERAL

This section contains the normal operating procedures for the aircraft.
All of the normal operating procedures required by the Aviation Authorities, as well as those necessary for operation of the aircraft, as determined by the operating and design features of the aircraft, are presented.
Normal operating procedures associated with optional systems and equipment, which require handbook supplements, are presented in Section 9, "Supplements".
This section should put the pilot in a position to use the aircraft and/or its systems and equipment optimally and safely. Therefore, it is recommended to make yourself familiar with the procedures and be able to master them.

This section is divided into two main parts:

1. The first part contains the normal procedure checklists. These checklists are clearly arranged to give an action sequence for normal procedures with little emphasis on the operation of the systems.

2. The second part provides amplified normal procedures corresponding to the normal procedures checklist items. These amplified normal procedures contain detailed information and explanations of the procedures and how to perform them.
   This portion of the section is not intended for use in flight.
   The numbers located in parentheses () after each paragraph heading indicate the corresponding checklist paragraph.

4.3 AIR SPEEDS FOR NORMAL OPERATION

The following air speeds are important for the safe operation of the aircraft. These air speeds apply to a standard aircraft up to maximum weight and under standard conditions at sea level.

Performance for a specific aircraft may vary from published values depending upon different condition; e.g: different equipment on the aircraft, another engine, and other atmospheric factors etc.

(a) Best Rate of Climb Speed ....80 KIAS
(decrease ofone knot per 1000 ft to min. 73 KIAS)
(b) Best Angle of Climb Speed ....70 KIAS
(c) Final Approach Speed (Flaps 40°) ....65 KIAS
(d) Balked Landing..65 KIAS
(e) Maximum Turbulent Air Operating Speed ....130 KIAS
(f) Max. Demonstr. Crosswind Velocity Takeoff/Ldg. ....20/17 kts

4.5 NORMAL PROCEDURES CHECKLIST

(a) Preflight Inspection

1. Cabin

Control Stick Lock ....UNLOCK
POH / Checklists ....AVAILABLE
Electrical Switches...OFF
Light Dimmer Switches ....OFF
Ignition Switch ....OFF
Circuit Breakers...CHECK IN
Throttle...CLOSED
Mixture ....IDLE CUT-OFF
Flight Controls ....CHECK FREE
Trim...CHECK, SET NEUTRAL

PREFLIGHT INSPECTION

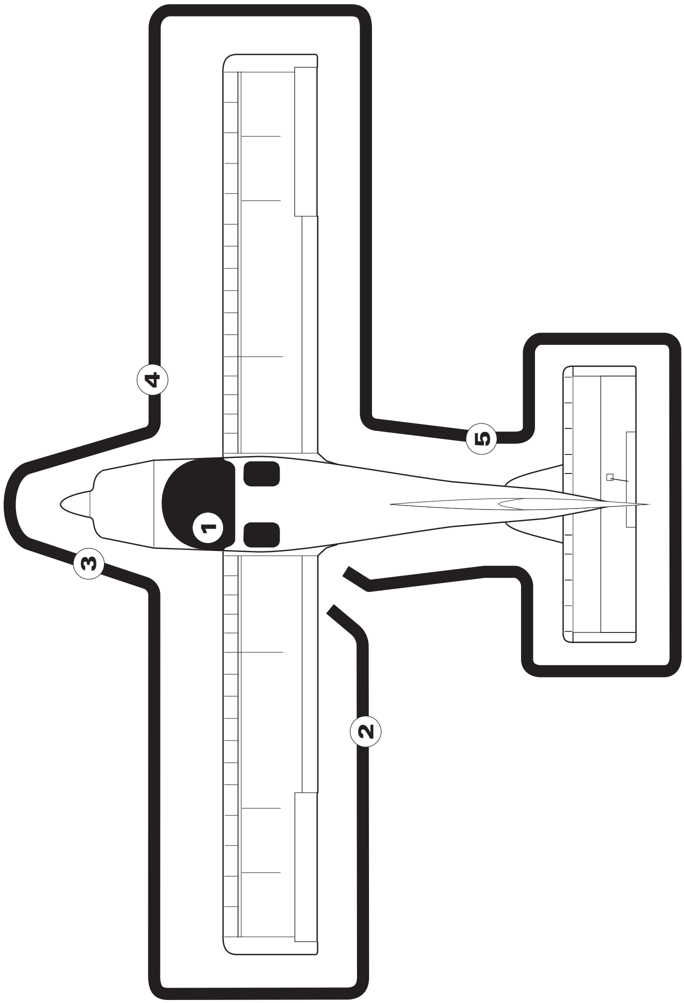


Figure 4-1

Seat position ....CHECK
BAT Switch ....ON
Fuel Quantity ....CHECK
Flaps EXTEND, Yellow Light “Flaps in Motion” ....CHECK
Landing Light (at Night) ....CHECK
Strobe Light (at Night)...CHECK
NAV Light (at Night) ....CHECK
Instr. / Map Lights (at Night) ....CHECK
BAT Switch ....OFF

2. Left Wing

Fuel Tank Sump ....DRAIN fuel into clear cup
Fuel ....CHECK for water,
sediment and proper fuel
Left Main Gear Strut and Wheel Fairing ....CHECK
Main Wheel Tire ....CHECK
for proper inflation and general condition
Wing Surface ....FREE of ICE, FROST, SNOW
Left-Side Top-Deck Hatch......................................CHECK for security
20° Flap Position Color Marking on Flap Track ....CHECK
for condition
Flap and Aileron..CHECK for freedom
of movement and security
Bonding Straps ....CHECK for security of attachment
and general conditions
Static Dischargers ....CHECK for security of attachment
and general conditions
Counter Weight ....CHECK for security of attachment
Wing Tip and Lights ....CHECK
Wing Leading Edge with Vortex Generators ....CHECK
Stall Warning System ....CHECK
Fuel Tank Vent Line..CHECK for free venting

Pitot Tube...REMOVE pitot tube cover
Pitot Tube Hole ....CHECK clear
Fuel Tank ....CHECK VISUALLY
for desired level
Fuel Filler Cap ....CHECK
secure and vent unobstructed

3. Nose

Cowling..CHECK
fasteners for security
Windshield ....CHECK for any damage
Air Inlets...CHECK for obstructions
Landing Light ....CHECK for condition
Propeller and Spinner ....CHECK for nicks and cracks
Generator Drive Belt..CHECK tension
Oil ....CHECK level
Oil Filler Cup..CLOSE
Oil Access Door...CLOSE
Nose Gear Strut and Wheel Fairing ....CHECK
Nose Wheel Tire CHECK
For proper inflation and general condition

4. Right Wing

Wing Surface ....FREE of ICE, FROST, SNOW
Fuel Tank ....CHECK VISUALLY
for desired level
Fuel Filler Cap ....CHECK
Secure and Vent unobstructed
Wing Leading Edge with Vortex Generators ....CHECK
Fuel Tank Vent Line..CHECK for free venting
Wing Tip and Lights ....CHECK
Counter Weight ....CHECK for security of attachment

Static Dischargers ....CHECK for security of attachment and general conditions
Flap and Aileron ....CHECK for freedom of movement and security
Bonding Straps ....CHECK for security of attachment and general conditions
20° Flap Position Color Marking on Flap Track ....CHECK for condition
Right-Side Top-Deck Hatch ....CHECK for security
Fuel Tank Sump ....DRAIN fuel into clear cup
Fuel ....CHECK for water, sediment and proper fuel
Right Main Gear Strut and Wheel Fairing ....CHECK
Main Wheel Tire ....CHECK for proper inflation and general condition

5. Fuselage

Fuselage Skins ....CHECK for stress cracks and fractures
Antennas ....CHECK
Empennage ....CLEAR of ICE, FROST, SNOW
Elevator ....CHECK for freedom of movement and security
Trim Tab ....CHECK for integrity
Rudder ....CHECK for freedom of movement and security
Static Dischargers ....CHECK for security of attachment and general conditions
Baggage Compartment ....CHECK baggage anchored down
Baggage Door ....CLOSED AND LOCKED
At fuselage bottom:
Fuel System Low-Point Drain......................DRAIN fuel into clear cup
Fuel.................................CHECK for water, sediment and proper fuel
Static/Dynamic System Drain Valve.........................CHECK for water
Cabin:
BAT Switch ....ON

Flaps....RETRACT
BAT Switch....OFF

(b) Before Starting Engine

Preflight Check....COMPLETE
BAT switch....ON
Cabin Lighting (at Night)....AS REQUIRED
Fuel Quantity....SUFFICIENT
Seat Belts and Harnesses....FASTENED/CHECK
Cabin Doors....CLOSED / LATCHED
Charts, Navigation Equipment, and
Flashlight (at Night)....ON BOARD
AVIONIC 1, AVIONIC 2 (IFR) Switches....OFF
Fuel Valve....CHECK ON

(c) Starting Cold Engine

Brakes....SET
ALT Switch....ON
INST LT / MAP LT Dimmer Switches (at Night)....ON
DOME LT Switch (at Night)....OFF
STROBE LT Switch....ON
Carburetor Heat....OFF
Throttle....6 mm (1/4 in.) OPEN
Mixture....FULL RICH
Primer.... ONE TO THREE STROKES
Propeller Area....CLEAR
Ignition Switch....START
Throttle....ADJUST
to 1000 - 1200 RPM
Oil pressure....CHECK
NAV LT Switch (at Night)....ON

(d) Starting Hot Engine

Brakes..SET
ALT Switch ....ON
STROBE LT Switch ....ON
Carburetor Heat ....OFF
Throttle ....6 mm (1/4 in.) OPEN
Mixture ....FULL RICH
Propeller Area ....CLEAR
Ignition Switch ....START
Throttle ....ADJUST
to 1000 - 1200 RPM
Oil pressure ....CHECK
NAV LT Switch (at Night) ....ON

(e) Engine Start With External Power Source

External Power Source ....CONNECT
Start engine according (b) and (c) or (b) and (d), then:
Throttle...IDLE
External Power Plug...DISCONNECT
Throttle ....ADJUST
to 1000 - 1200 RPM
Ammeter ....CHECK

NOTE! If engine does not start within 10 sec., disengage the starter and try again after a few seconds.

(f) Warm-Up

Throttle...1000 - 1200 RPM
Avionic Equipment ....ON AS REQUIRED

Vacuum ....CHECK
Ammeter ....CHECK
Oil Temperature...CHECK
Circuit Breakers ....CHECK

(g) Taxiing

Taxi Area...CLEAR
Throttle...APPLY SLOWLY
Brakes ....CHECK
Controls ....CHECK for free and correct movement

(h) Ground Check

Brakes ....APPLY
Throttle ....1800 RPM
Magnetos ....CHECK “L“ then “R“
Maximum Drop 175 RPM
Maximum Difference 50 RPM between magneto
Ignition Switch..“BOTH“
Carburetor Heat ....ON
RPM drop at least 50 RPM
Throttle..IDLE
Engine runs smooth with...500 - 700 RPM
Carburetor Heat ....OFF
Throttle...1000 - 1200 RPM
Voltage...CHECK
Oil Pressure ....CHECK
Oil Temperature...CHECK
Fuel Pressure ....CHECK

(i) Before Takeoff

Brakes ....APPLY
Throttle. ....1000 - 1200 RPM
Seats ....ENGAGED
Seat Belts and Harnesses.......................................FASTENED/CHECK
Empty Seat ....Seat Belts SNUGLY FASTENED
Cabin Doors ....CLOSED AND LATCHED
Instrument/Map Light (at Night)...ADJUST
Primer ....LOCKED
Fuel Valve ....CHECK ON
Pitot Heat...ON
Aux. Fuel Pump ....ON
Fuel Quantity ....CHECK
Mixture..FULL RICH
Carburetor Heat ....OFF
Ignition Switch...“BOTH“
Engine Parameters...CHECK
Flight Instruments..adjust and CHECK
Navigation Equipment ....OPERATIONAL as required
Trim ....SET

(j) Takeoff

Normal Conditions

Flaps...20°
Brakes ....RELEASE
Throttle ....FULL OPEN
At a speed of 53 KIAS..ROTATE to lift-off
After lift-off accelerate to:
Airspeed ....65 - 75 KIAS
After an altitude of 50 ft is achieved:

Wing Flaps .... RETRACT
Airspeed .... 80 KIAS

Short Field

Flaps.. 20°
Brakes .... APPLY
Throttle .... FULL OPEN
When full engine power is available:
Brakes .... RELEASE
At a speed of 53 KIAS .... ROTATE to lift-off
After lift-off accelerate to:
Airspeed .... 62 KIAS
After an altitude of 50 ft is achieved:
Wing Flaps .... RETRACT
Airspeed .... 80 KIAS

(k) Climb

Flaps .... RETRACTED
Trim .... ADJUST
Best Rate Climb Speed .... 80 KIAS
Best Angle Climb Speed .... 70 KIAS
Aux. Fuel Pump .... OFF
Engine Parameters .... CHECK

(l) Cruise

Trim .... SET
Cruise Power ....in accordance with the flight planning SET

Mixture ....ADJUST
Engine Parameters..CHECK
Fuel Quantity ....CHECK

CAUTION !

Prolonged operation with a lean mixture, at more than 75% engine power, could result in engine damage.

(m) Descent

Carburetor Heat...AS REQUIRED
Mixture ....ENRICH AS REQUIRED
Power ....SET
Airspeed ....AS REQUIRED
Cylinder Head Temperature..CHECK

(n) Before Landing

Seat Belts and Harnesses..FASTENED/CHECK
Mixture..FULL RICH
Aux. Fuel Pump ....ON
Carburetor Heat ....ON
Landing Light ....ON
Flaps ....As required SET
Trim ....SET
Parking Brake Control Knob (optional).............CHECK PUSHED IN
Final Approach Speed:
Flaps 40° ....65 KIAS

NOTE: It is recommended that all necessary landing checks and actions in the cabin are completed before turning

on to the final approach. In this way, the pilot's attention can be directed completely to controlling the aircraft.

(o) Landing

Normal Conditions

Flaps..40°
Airspeed..65 KIAS
Flare the aircraft, so that it flares out at approx. 0,5 m over, and parallel to, the runway surface.
Increase pitch with decreasing speed, so that the aircraft slowly approaches the ground and make contact with the lowest possible speed - main wheels first. After touchdown:
Nose Wheel ....LOWER GENTLY
Braking...AS REQUIRED

Balked Landing

Throttle..FULL OPEN
Carburetor Heat...OFF
Airspeed ....Stabilize 65 KIAS
Trim ....SET
After reaching the safety height of 50 ft:
Flaps...RETRACT

(p) After Landing

Flaps...RETRACT
Carburetor Heat...OFF
FUEL PUMP Switch ....OFF

PITOT HT Switch ....OFF
LDG LT Switch ....on day OFF

(q) Engine Shut Down

Flaps..RETRACT
Avionics ....OFF
Throttle..1000 - 1200 RPM
Mixture..IDLE CUT-OFF
Ignition Switch..OFF
STROBE LT Switch ....OFF
NAV LT Switch (at Night)..OFF
DOME LT Switch (at Night)..ON
INST LT /MAP LT Dimmer Switch (at Night)..OFF
ALT / BAT Switch (on Day)..OFF
ALT Switch (at Night)..OFF

(r) After Engine Shut-Down

All Electrical Equipment ....OFF
Ignition Switch..OFF
Throttle..FULL AFT
Mixture..IDLE CUT-OFF
Control Stick ....LOCKED
DOME LT Switch (at Night)..OFF
BAT Switch (at Night)..OFF
Wheel Chocks ....IN PLACE
Tie Downs ....SECURE
Coverings ....INSTALLED

4.7 AMPLIFIED NORMAL PROCEDURES

The following provides detailed information and supplementary notes for normal operation of the aircraft.

(a) Preflight Inspection (4.5 a)

The aircraft should be given a thorough preflight check. A check of the aircraft's logs is also required. Scheduled aircraft inspections and maintenance must be completely documented.
The main component of preflight inspection is an aircraft visual check in accordance with the check-list (Fig. 4-1).

1. Cabin

In the cabin: first, unlock the control stick.
You should ascertain that a current SA 160 flight manual as well the checklists are on-board.
The instrumentation and the control elements of the cockpit are to be checked for external damage.
Check the fuel quantity by means of the fuel level indicator.
All switches (inclusive the ignition switch) must be OFF.
Verify the instrument/map light dimmer switches are in off position.

CAUTION !

When the instrument light dimmer switch is in ON position the annunciator lights “Fuel Pump” and “Flaps in Motion” will be dimmed (See Section 7, “Lights”).

All circuit breakers are in ON position. The throttle control lever should be in the closed position and the mixture in idle cut-off.
While moving control stick, check the ailerons and the elevator for free and correct movement.
Check the trim for freedom of movement and set to neutral.
The seat position and its locking are to be checked.
Extend the wing flaps and leave this position for a better view of mechanics.

2. Left Wing

Bleed fuel from the left wing fuel tank drain into a clear vessel and inspect for water and sediment contamination. Drain until water or sediment is gone. Both fuel tank sumps should be drained daily prior to the first flight.
The left main gear strut with wheel fairing is to be checked for damage. The tire should be checked for proper inflation and condition.
Next, check the wing surface is clear of ice, frost, snow or other extraneous substances.
The quick-release locks of the top-deck hatches for the left wing are to be checked for proper lock.
Verify the 20° flap position color marking on the inboard flap track is present and in good condition.
At the wing trailing edge, the wing flaps and ailerons as well as its hinges are to be checked for damage and condition, the ailerons for smoothness and freedom of operation. Bonding straps and static dischargers should be firmly attached and in good condition.
The security of attachment of the aileron counter weight is to be checked.
Check the wing tip and the navigation/strobe lights for damage.
Check the wing leading edge with the vortex generators for any damage.
With ALT / BAT in ON position it is possible to check the general function of the stall warning system by carefully moving upwards the small plate on the transmitter.

Check the end of fuel tank vent line for obstructions.
Remove the cover from the pitot tube and check the pitot pressure hole for integrity and that it is clear of obstructions.
Open the fuel cap and visually check the fuel level for correspondence with fuel level indicator reading. After this, replace cap securely.

3. Nose Section

Check the cowling for damage and correct fitting. All quick-release fasteners of the cowling must be locked. Check the windshield for damage such as cracks and scratches and clean if necessary. Check the air inlets for damage and obstructions (use only authorized cleaning materials).
The propeller and the spinner are to be checked for nicks, cracks, or other defects.
Through the right air inlet check the proper tension of the alternator belt.
Open the oil access door on the right side of the upper cowling and check the oil level with the dipstick. It should be no less as 5 liters (5,3 qts). Then, close the oil filler cap accurately. Close the oil access door.
Check the nose gear strut and the wheel fairing for damage. If required remove the wheel chock. Check tire for cuts, wear, and proper inflation.

4. Right Wing

The wing surface should be clear of ice, frost, snow or other extraneous substances.
Open the fuel cap and visually check the fuel level for correspondence with fuel level indicator reading. After this, replace cap securely.
Check the wing leading edge with the vortex generators for any damage. The end of fuel tank vent line must be free of obstructions.
Check the wing tip and the navigation / strobe lights for mechanical

damage. The security of attachment of the aileron counter weight is to be checked.
At the wing trailing edge, the ailerons and wing flaps as well as its hinges are to be checked for damage and condition, the ailerons for smoothness and freedom of operation. Bonding straps and static dischargers should be firmly attached and in good condition.
Verify the 20° flap position color marking on the inboard flap track is present and in good condition.
The quick-release locks of the top-deck hatches for the right wing are to be checked for proper lock.
Next, through the quick drain of the right wing fuel tank sump drain fuel into clear cup and check for water and sediment. Drain until water or sediment is gone.
The right main gear strut and wheel fairing is to be checked for damage. The tire should be checked for proper inflation and condition.

5. Fuselage

The fuselage skins are to be checked for damage such as delaminations or tears and the antennae for their integrity and security.
Check the static ports for obstructions and integrity.
The empennage should be clear of ice, frost, snow or other extraneous substances.
The security of attachment of the horizontal stabilizer, and the freedom of movement of the elevator are to be checked. The piano type hinges of the elevator show no damage and are secured properly as well as the elevator pushrod. The trim tab is in neutral position. Check trim tab pushrod. Rudder as well as its hinges are to be checked for damage, smoothness and freedom of operation there.
The static dischargers should be firmly attached and in good condition.
The baggage in the baggage compartment should be securely anchored down. Close the baggage door and lock it by means of both locks.

Next, through the fuel system low-point drain located on the bottom of the cabin, drain fuel into clear cup and check for water and sediment. Drain until water or sediment is gone.
Check the pitot and static systems low-point drains for water.
Finally, enter the cabin and turn ON the BAT switch. Retract the flaps and switch BAT OFF.

(b) Before Starting Engine (4.5 b)

Prior to starting the engine, a pre-flight check must be Icompleted. At night use the dome light. The fuel on board must be sufficient for the flight. Pilot and passenger must be securely fastened by the seat lap-belts and shoulder harnesses and the doors must be closed and secure.

NOTE: Make sure that with the seat belts securely fastened all controls can be easily reached and can be move full travel without obstruction.

Check all navigation material necessary for the flight is on board (at night additionally a flashlight for emergency purposes).
The AVIONICS switch should be in OFF position.

CAUTION !

Any Avionics in the ON position could be damaged during engine start.

NOTE: Equipment unnecessarily switched ON during the start sequence, could complicate the starting process because of their power consumption.

Check the fuel valve is in ON position for fuel supply.

(c) Starting Cold Engine (4.5 c)

Set the brakes and turn on the alternator and the strobe light. At night turn on the instrument and map lights. They should be switched on to check the engine parameters on the VM 1000 display during start. Check the carburetor heat is OFF.
It is recommended, that when starting a cold engine, prime it by pumping throttle one to three strokes. In this way extra fuel becomes injected directly into the cylinder fuel-air induction system.
Then open the throttle lever approximately 6 mm (1/4 in.). Set the MIXTURE lever to the FULL RICH position.
For aircraft equipped with a primer system, it is recommended,that when starting a cold engine, prime it (max. 3 strokes) and secure the primer button.

WARNING !

Overpriming complicates the engine starting process, it may result in a discharge of fuel or even an engine fire.
A unlocked primer button can affect negatively to engine operation.

After ascertaining that the propeller area is clear of people (6 meters), engage the starter by rotating the ignition switch clockwise. As soon as the engine fires, release ignition switch, and move the throttle to attain 1000 - 1200 RPM. If the engine does not fire within 5 - 10 seconds, disengage the starter and repeat starting procedure after approx 2 minutes.
The oil pressure immediately after starting should at least be 25 psi. Otherwise, shut down engine.
At night, turn ON the NAV light.

(d) Starting Hot Engine (4.5d)

Set the brakes and turn on the alternator and the strobe light. At night, turn on the instrument and map lights. They should be switched on to check the engine parameters on the VM 1000 display during start. Check the carburetor heat is OFF.
Open the throttle lever approximately 6 mm (1/4 in.). The MIXTURE lever must be in FULL RICH position.
After ascertaining that the propeller area is clear of people (6 meters), engage the starter by rotating the ignition switch clockwise. As soon as the engine fires, release ignition switch, and move the throttle to attain 1000 - 1200 RPM. If the engine does not fire within 5 - 10 seconds, disengage the starter and repeat starting procedure after approx. 2 minutes.
The oil pressure immediately after starting should at least be 25 psi. Otherwise, shut down engine. At night turn ON the NAV light.

(e) Engine Start With External Power Source (4.5e)

The voltmeter indication on the VM 1000 display will show the proper connection of the external power source. If necessary the external power may be electrical disconnected from aircraft by turning “BAT” off.
After the engine has started according to (b) and (c) or (b) and (d), reduce power to idle and disconnect the external power source from the aircraft by an assistant.
After removing the external power source, increase the engine power to 1000 - 1200 RPM and check that the ammeter indicates an alternator output.

CAUTION !

If oil pressure is not indicated or it is too low within 30 seconds after engine start, stop the engine and determine the cause.

NOTE: In very cold weather it will take a few seconds longer to get an oil pressure indication.

NOTE: Starter manufacturers recommend limiting cranking periods to 30 seconds with a two minutes rest between cranking periods. Longer starting attempts will shorten the life of the starter.

(f) Warm up (4.5f)

Warm-up the engine at 1000 - 1200 RPM. Engine is warm for takeoff when throttle can be opened without engine faltering.
In the meantime, turn on required electrical equipment such as the navigation equipment, setup if necessary and check for proper functioning.
Check all engine parameters, the volt-/ammeter as well as the suction gauge readings. All circuit breakers must be ON.

(g) Taxiing (4.5 g)

After ascertaining the area in the intended taxi direction is clear, increase the engine power slowly. Taxi forwards a few feet, and apply the brakes to determine their effectiveness. While taxiing, make slight turns to check the function of the steering. Check once more ailerons, elevator and rudder for proper deflection, smoothness and

freedom of movement in their entire operating range. Avoid holes and ruts in the taxi surface when taxiing over uneven ground.
Do not operate the engine at high RPM while running up or taxiing over gravel, loose stones, or any loose material to prevent abrasion and stone damage to the propeller blades.

(h) Ground Check (4.5h)

Set the brake and advance the throttle to 1800 RPM. Move Ignition switch to L (magneto) Position, note RPM and switch back to BOTH. Move Ignition switch to R (magneto) position, note RPM and switch back to BOTH. RPM drop should not exceed 175 RPM on either magneto and the difference between the magnetos should not exceed 50 RPM. Move the throttle control to the most rear position. Engine must be run at 500 - 700 RPM without extreme vibrations.
Open the throttle smoothly to full throttle. The engine should accelerate to maximum RPM without faltering.
Set 1800 RPM and switch ON carburetor heat. Its operation makes itself noticeable through a RPM drop at least of 50 RPM. Turn OFF carburetor heat. The RPM should adjust itself.
Check engine parameters on VM 1000 display. The oil pressure, the oil temperature and the fuel pressure must be within the green ranges.

CAUTION !

Since the engine is closely cowled for efficient in-flight engine cooling, do not operate it more than 3 minutes at maximum RPM.

Prolonged engine operations below 1000 RPM may cause spark plug fouling.

(i) Before Takeoff (4.5i)

All circumstances for each particular takeoff, such as runway surface, meteorological conditions etc., should be considered.
With brakes set to avoid fouled spark plugs and battery discharge, perform the necessary checks with approx. 1000-1200 RPM engine speed.
Ensure that the seats are fixed, and both seat belts are fastened even if no passenger. Check that the cabin doors are closed and latched.
At night adjust instrument and map light intensity corresponding to surrounding light conditions.
Check the fuel valve is open. Turn ON the auxiliary fuel pump to prevent loss of power should the engine driven fuel pump fail during takeoff. Ensure the fuel quantity is sufficient for the planned flight.
Check the mixture is in the FULL RICH position, the carburetor heat is OFF and the Ignition switch is in BOTH position.
Check again that all engine parameters are within the permissible limits.
Set up the attitude indicator and the compass. Adjust the barometric altimeter as required. Check the navigation equipment required for planned flight is operational.
Adjust the trim slightly aft of neutral.
Set flaps in takeoff position and check visually that they are down.

NOTE: A minimum amount of leaning is permitted for smooth engine operation when taking off at high elevation airfields.

(j) Takeoff (4.5 j)

Normal Conditions

Normal take-offs are accomplished with flaps in 20° position. However, under difficult wind conditions such as crosswind near at the maximum demonstrated crosswinds, a takeoff with flaps up may be advisable.

Set the trim as required.
Move the throttle control fully forward and allow the aircraft to accelerate to 53 KIAS. Lift the nose wheel and let the aircraft lift-off.
Accelerate the aircraft in a shallow climb to 65 KIAS and then transfer to climb flight with 65 - 75 KIAS.
Slowly retract the flaps at an altitude of at least 50 ft and perform further climbing with 80 KIAS airspeed.

Short Runway

Lower the flaps to takeoff position 20°. Set the trim as required. Hold the brakes on.
Move the throttle control fully forward and only upon reaching the full engine power, release the brakes.
After reaching a airspeed of 53 KIAS, lift the nose wheel and let the aircraft l ift-off.
Accelerate the aircraft in a shallow climb to 65 KIAS and then transfer to climb flight with this speed.
Once clear of any obstacles, slowly retract the flaps at an altitude of at least 50 ft and climb at 80 KIAS airspeed.

Cross- Wind

When performing a flap-ups take off due to heavy crosswinds, the aircraft must be accelerated to 60 kias prior to nose wheel lift off.

(k) Climb (4.5 k)

Once established into the climb (flaps-up and A/C trimmed),
Turn OFF the auxiliary fuel pump.
The best rate of climb speed at maximum weight is 80 KIAS (Mean Sea Level). The speed decreases one knot per 1000 ft to 75 kts as minimum. The best angle of climb speed is 70 KIAS (flaps retracted).
For climbing en route, the best rate of climb speed plus 5 - 10 KIAS is recommended. The visibility over the aircraft is therefore increased.
During the climb, the engine parameters are to be checked, especially the cylinder head temperature. Under very high outside temperatures, climb speed can be increased to maximize engine cooling.

(l) Cruise (4.5 l)

Adjust the elevator trim, to make flying on long routes easier.
The cruise speed and the cruise power settings depend on many factors such as altitude, air temperature, aircraft loading and so on.
The normal cruising power is 55% - 75% of the rated horsepower of the engine. Airspeeds, which may be obtained at various altitudes and power settings, can be determined from the performance graphs provided in section 5.
A correct mixture setting can significantly reduce fuel consumption. For that:

(a) Establish desired cruise power and allow engine parameters to stabilize.
(b) Press BUTTON 1 at VM 1000 display (see Section 7) to activate the "Lean EGT Mode".

CAUTION !

Never exceed the maximum red line cylinder head temperature limit.
Always return the mixture to full rich before increasing power settings.
Prolonged operation with a lean mixture, at more than 75% engine power, can result in engine damage.
Avoid rough engine operation

(c) Smoothly lean engine mixture by rotating the knob counter-clockwise to start the EGT bars climbing (about one bar per 2 seconds). If the leanest EGT has been detected, the bar graph for that EGT will begin flashing. Stop leaning.
(d) Enrich engine mixture by rotating mixture knob counter-clockwise to set final mixture as follows:
   (1) For *Maximum Power Cruise* (up to 75% power) - 150°F on rich side peak EGT.

(2) For *Best Economy Cruise* (75% power and below) Operate at peak EGT, or enrich to obtain engine smoothness.

For further information, refer to Lycoming Operator's manual and VM 1000 Manual.

While cruising, check the engine parameters on VM 1000 display frequently. Keep track of fuel status in terms of flight time and fuel burn per hour as well as by indications of fuel level indicators.

(m)Descent (4.5 m)

Before descent turn ON the carburetor heat or set according to atmospheric conditions (if CAT indicator is installed, check reading), and enrich the mixture as required.

While performing a power off descent, in order to check the power response and prevent plug fouling, periodically partially open and then close the throttle. When leveling off, set power as required and select carburetor heat OFF.

NOTE: In order to avoid an overcooling of the engine avoid prolonged descent at high speed and low power.

WARNING !

With less than 12 liters (3 U.S. Gal.) per each wing tank (”Lo” at indicator) power on descents (50 - 75%) with flaps fully extended and more as 70 KIAS airspeed must be limited to maximum 10 minutes duration.

Before continuing descent, perform a 3 minute level flight with flaps up (refer section 7).

(n) Before Landing (4.5n)

Check that seat belts are fastened securely.
The mixture control should be kept FULL RICH to ensure maximum acceleration if it should be necessary.
Turn ON the auxiliary fuel pump, the carburetor heat, and the landing light.
Extend the flaps as required. On final approach, landing flaps should be selected according to the runway surface, wind conditions and aircraft loading. Adjust trim.
Verify the parking brake control knob is pushed in.

CAUTION !

If landing is made with the parking brake set, the brakes will maintain any pressure applied after touchdown.

The final approach speed with flaps extended to 40° is 65 KIAS.

NOTE! It is recommended that all necessary landing checks and actions in the cabin are completed before turning into the final approach. In this way, the pilot's attention can be dedicated to controlling the aircraft

CAUTION !

The maximum speed with flaps in extended position is 90 KIAS.

(o)Landing (4.5o)

Normal Conditions

The amount of flap used during approach and landing should be varied according to the runway surface, wind conditions and aircraft loading. It is recommended generally to perform the touch down at the minimum possible safe speed consistent with existing conditions.
Under normal conditions, that will be with full extended flaps and approach speed of 65 KIAS. When landing in a strong wind, particular in crosswind, it can be required to select a higher approach speed and extend the flaps only partially or not at all.
When landing, flare the aircraft, so that it flares out at approx. 0.5 m over and parallel to the runway surface.
While decreasing speed, increase angle of attack by easing the stick back, so that the aircraft contacts with the lowest possible speed main wheels first at the lowest possible speed.
After touch down, hold the nose wheel off the ground as long as possible, and as the aircraft slows down, gently lower the nose.
Apply brakes as required.

Balked Landing

After making the decision for a balked landing; move the throttle full forward swiftly but not abruptly and turn OFF the carburetor heat to ensure the maximum engine power.
An easy torque effect of the aircraft around the longitudinal axis to the Whilst accelerating, transfer aircraft to level flight and then to climbing flight.
Stabilize at a speed of 65 KIAS. Retract flaps slowly upon reaching a safe altitude.

(p) After Landing (4.5p)

Retract flaps.
Turn OFF the carburetor heat and the auxiliary fuel pump.
Turn OFF pitot tube heat, if it was in operation.
Turn OFF the landing light.

NOTE: Unnecessary further electrical equipment may be turned OFF to reduce the discharge of the battery.

(q) Engine Shut Down (4.5q)

Check the flaps are completely retracted.
Turn OFF all avionics.
Adjust the throttle to 1000 - 1200 RPM and pull the mixture control back to IDLE CUT-OFF. ,Turn OFF the ignition switch.
Turn off the strobe light and at night the navigation lights.
Turn off the instrument and map lights, cabin lighting turn on the dome light.
If the dome light is needed, leave the BAT switch on.

(r) After Engine Shut Down(4.5 r)

In the cabin, check all electrical equipment is turned OFF. Ignition switch and ALT/BAT switch must be switched OFF. The throttle must be closed and the mixture in the position IDLE CUT-OFF.
The installation of control locks protects against damage in strong wind and preserves the flying control hinges. Chocking the main wheels and the installation of tie downs prevents inadvertent run away or turnover of the aircraft in high wind conditions.

SECTION 5
PERFORMANCE

TABLE OF CONTENTS

Page

5.1 GENERAL

This SECTION contains all the prescribed performance data as well as supplementary information for this aircraft.
Performance data for optional equipment that requires handbook supplements is provided in Section 9, "SUPPLEMENTS".

5.3 PERFORMANCE PARAMETERS AND FLIGHT PLANNING - INTRODUCTION

The performance information on the following pages shows what is to be expected of the aircraft under various conditions. They are also a means for sufficient and correct flight planning.
The data has been computed from extensive flight tests with the aircraft and engine in good condition and is approximated to average piloting techniques.
Effects of ambient conditions (such as a soft or grass runway surfaces fortakeoff and landing, or winds aloft on cruise and range performance) are not considered on the charts, and tables must be interpolated by the pilot.
Performance information presented in the range and endurance profile charts allow for 45 minutes of reserve fuel at the specified power settings.
Fuel consumption is based on flight with appropriate leaning techinque for the mixture at different altitudes.
The recommended procedures for leaning mixture are explained in Section 4, 4.7 "AMPLIFIED NORMAL PROCEDURES" of this handbook.
Due to the various influences on fuel consumption during flight, (use all available information) check fuel flow and quantity frequently while in flight.
To obtain the performance indicated in the charts, follow the chart procedures.
This section contains a flight planning example. This example shows the order as well as the manner in which to perform flight planning with reasonable accuracy by using the performance charts and tables.
In addition, each chart includes it own example.

5.5 FLIGHT PLANNING EXAMPLE

The following example uses information from the performance charts to plan a flight.

Example

The following information is used:

Aircraft Configuration

Takeoff Weight	975 kg (2150 lbs)
Usable Fuel	110 l (29.1 U.S.Gal.)

Takeoff Conditions

Airfield Pressure Altitude	930 ft
Air Temperature	13 °C
Wind Component	14 kts Headwind
Runway Length	800 m(2625 ft)

Cruise Conditions

Total Distance	280 NM
Cruise Pressure Altitude	6000 ft
Cruise OAT	3 °C
Wind	20 kts Headwind

Landing Conditions

Airfield PressureAltitude	2000 ft
Air Temperature	11 °C
Runway Length	1200 m (3937 ft)

(a) Takeoff

For this the chart: fig. 5-6 "Takeoff Distance (for short fields)" is to be used. The values shown are based on the normal procedure "Takeoff - Short Field“ (see Section 4, “NORMAL PROCEDURES“).
By means of the appropriate column with the air temperature and the line with corresponding altitude, the takeoff distance is found.
Conservative values can be safely established by reading the chart at the next higher value of altitude or temperature. This results in the following:

Ground Roll	370 m (1214 ft)
Total distance to clear a 50-ft obstacle	475 m (1558 ft)

The runway length of 2000 ft.is therefore sufficient.
The Chart figure then shows the existing wind conditions. The correction for a 14 kts headwind becomes;

14 kts/9 kts x 10% = 15.6% decrease

This results in the following takeoff distances, corrected for the wind:

Ground Roll	312 m (1024 ft)
Total distance to clear a 50-ft obstacle	329 m (1316 ft)

(b) Cruise

The cruising altitude and the winds enroute are determined from route restrictions and meteorological conditions. The optimal power setting selection for cruise must be determined based on several factors. This includes the closer consideration of the cruise performance data (Fig. 5-9), range profiles (Fig. 5-10), and endurance profile charts (Fig. 5-

11).

The relationship between engine power and range is presented in the range profile chart. Accordingly, the most economical fuel consumption or the longest range will be achieved at a cruise power of approx. 65% at 6000 ft.
Next the cruise performance table data can be read, by using the 65% cruise power determined above and the other given values the following result is obtained:

True Airspeed	117 kts
Fuel Consumption	28 l/h (7.4 U.S.Gal./h)

(c) Fuel Required

The fuel required for this flight may be estimated by use of the chart "Time, Fuel, and Distance to climb" (Fig. 5-8) and the Cruise Performance chart (Fig. 5-9).
These values are based on standard ICAO temperatures. However, they are sufficiently precise for most flight planning purposes. Temperature correction is explained on the " ... Performance" ... Note.

Fuel Required for Climb	6.4 Liters (1.69 U.S.Gal.)
Climb Distance	12.6 NM

The cruise distance is now:

Total Distance		280
Climb Distance	-	13
Cruise Distance	=	267 NM

With an assumed headwind of 20 kts enroute, the ground speed for cruise is:

```
  117
-  20
=  97 kts
```

Using these two values, the time for the cruise can be calculated:

267 NM/97 kt = 2.8 h

The fuel required for cruise is:

2.8 h x 28 l/h (7.4 U.S.Gal./h) = 78.4 l (20.7 U.S.Gal.)

45-minute reserve:

45/60 x 28 l/h (7.4 U.S.Gal./h) = 21 l (5.54 U.S.Gal.)

Next the total fuel required can be calculated as follows:

Engine start, taxi, and takeoff	4.0 l (1.05 U.S.Gal.)
Climb	6.4 l (1.69 U.S.Gal.)
Cruise	78.4 l (20.7 U.S.Gal.)
Reserve	21.0 l (5.54 U.S.Gal.)
Total fuel required	**109.8 l (29 U.S.Gal.)**

(d) Landing

For estimating the landing distance at the destination airfield, a procedure similar to takeoff should be used.
For this fig. 5-12 "Landing Distance (for short fields)" is to be used. The

values are based on using the normal procedure “Landing - Short Field“ (see Section 4 “NORMAL PROCEDURES“).
By means of the corresponding column with the air temperature and the line with corresponding altitude, the landing distances are determined.

Conservative values can be safely determined by reading the chart at the next higher value of altitude or temperature. In such a way, the given situation equals:

Ground Roll	295 m (968 ft)
Landing distance to clear a 50-ft obstacle	725 m (2379 ft)

5.7 USE OF PERFORMANCE CHARTS

Tabulations of performance are presented in increments of temperature, altitude and other variables. Performance for a given set of conditions may be approximated as follows:

Takeoff, climb, and landing - Enter tables at next higher increment of altitude, temperature, weight and at zero wind.

For cruise: Enter tables at next lower increment of temperature, altitude and fuel loading; and the next higher increment of weight if applicable.
To obtain exact performance values from tables, it is necessary to interpolate between the incremental values.

WEIGHT lbs	TAKEOFF-SPEED ~ KIAS		PRESS ALT ft	ISA+20 °C		ISA+30 °C	
	LIFT OFF	50 ft		GROUND ROLL ft	TOTAL TO CLEAR 50 ft OBS ft	GROUND ROLL ft	TOTAL TO CLEAR 50 ft OBS ft
2150	58	62	MSL	1329	1690	1411	1788
			1000	1394	1772	1493	1886
			2000	1493	1870	1575	1985
			3000	1624	2034	1722	2149

Example:

Given:
- Takeoff Weight 2150 lbs
- Air Temperature 40 °C
- Airfield Pressure Altitude 2200 ft
- Headwind 10 kts

Find:
- Takeoff Speed at Lift-Off
- Speed at 50 ft
- Ground Roll
- Total Distance to Clear 50 ft Obstacle

(a) Approximation Method

Read values at 2150 lbs, ISA+30 °C, and 2000 ft:

- Lift-Off Speed	58 KIAS
- Speed at 50 ft	62 KIAS
- Ground Roll	1575 ft
- Total to Clear a 50 ft Obstacle	1985 ft

(b) Interpolation Method

- The example airfield pressure altitude is 20% of the difference between 2000 ft and 3000 ft.
- The temperature is 50% of the difference between 35 °C and 45 °C.

Between the read values, the corresponding percentages are to be considered:

- Lift-Off Speed	58 KIAS
- Speed at 50 ft	62 KIAS
- Ground Roll	1562 ft
- Total to Clear a 50 ft Obstacle	1960 ft

The correction for headwind:

For a 10 kts headwind, decrease distances by 10%.

Ground Roll	1562 ft - (10%)x 1562 ft = 1406 ft
Total to Clear a 50 ft Obstacle	1960 ft - (10%)x 1960 ft = 1764 ft

5.9 PERFORMANCE CHARTS

AIRSPEED CALIBRATION

CONDITIONS:

KIAS ASSUMES ZERO INSTRUMENT ERROR.

FLAPS 00°	KIAS	65	75	85	95	105	115	125	>135
	KCAS	64	74	84	94	107	115	126	>135
FLAPS 20°	KIAS	55	60	65	70	80	90	-	-
	KCAS	54	59	64	70	80	90	-	-
FLAPS 40°	KIAS	55	60	65	70	80	90	-	-
	KCAS	54	59	64	70	80	90	-	-

Kias : Knots Indicated Air Speed
Kias : Knots Calibrated Air Speed

EXAMPLE:

FLAPS	20°
INDICATED AIRSPEED	60 KIAS
CALIBRATED AIRSPEED	59 KCAS

Figure 5-1(1)

AIRSPEED CALIBRATION
(Alternate Static Source)

CONDITIONS:

COCKPIT VENTILATION OFF

Normal KIAS	50	60	70	80	90	100	110	120	130	140	150	160
Alternate KIAS	51	61	73	85	96	107	119	129	140	151	161	172

NOTES:

1. INFLUENCE OF VENTILATION: WITH THE COCKPIT VENTILATION OPEN (ONE OR TWO FRESH AIR NOZZLES), THE VALUES IN THE ALTERNATE KIAS COLUMN DECREASE BY 0.5 KT.
2. INFLUENCE OF THE CABIN HEAT IS FOUND TO BE NEGLIGEABLE.

EXAMPLE:

DESIRED AIRSPEED 70 KIAS

AIRSPEED INDICATOR READING 73 KIAS

Figure 5-1(2)

ALTIMETER CORRECTION

CONDITIONS:

MSL
KIAS AND INDICATED ALTITUDE ASSUME ZERO INSTRUMENT ERROR.

CONDITION	CORRECTION TO BE ADDED ~FEET								
	KIAS								
	55	60	65	70	80	90	105	115	125
FLAPS 00°	-10	-10	-10	-10	-10	-10	+15	0	+10
FLAPS 20°	-10	-10	-5	-5	-5	0	-	-	-
FLAPS 40°	-10	-10	-5	-5	-5	0	-	-	-

EXAMPLE:

FLAPS 0°
INDICATED AIRSPEED 95 KIAS

ALTIMETER CORRECTION -10 ft

Figure 5-2(1)

ALTIMETER CORRECTION
(Alternate Static Source)

CONDITIONS:

MSL
COCKPIT VENTILATION OFF

KIAS	60	70	80	90	100	110	120	130	140	150	160
CORRECTION TO BE ADDED - FEET	-10	-25	-40	-50	-70	-70	-90	-110	-130	-145	-165

NOTES:

1. INFLUENCE OF VENTILATION: WITH THE COCKPIT VENTILATION OPEN (ONE OR TWO FRESH AIR NOZZLES), ADD TO THE VALUES IN THE “CORRECTION TO BE ADDED” COLUMN +5 ft.
2. INFLUENCE OF THE CABIN HEAT IS FOUND TO BE NEGLIGEABLE.

EXAMPLE:

FLAPS	0°
INDICATED AIRSPEED	90 KIAS
ALTIMETER CORRECTION	-50 ft

Figure 5-2(2)

TEMPERATURE CONVERSION

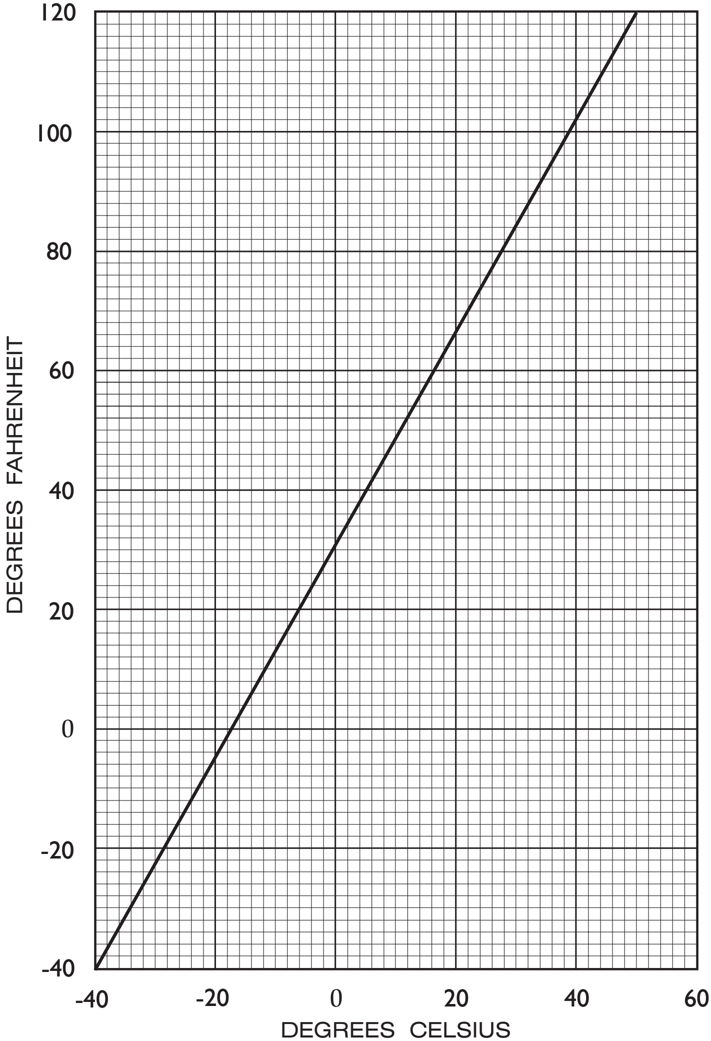


Figure 5-3

LITERS / GALLONS CONVERSION

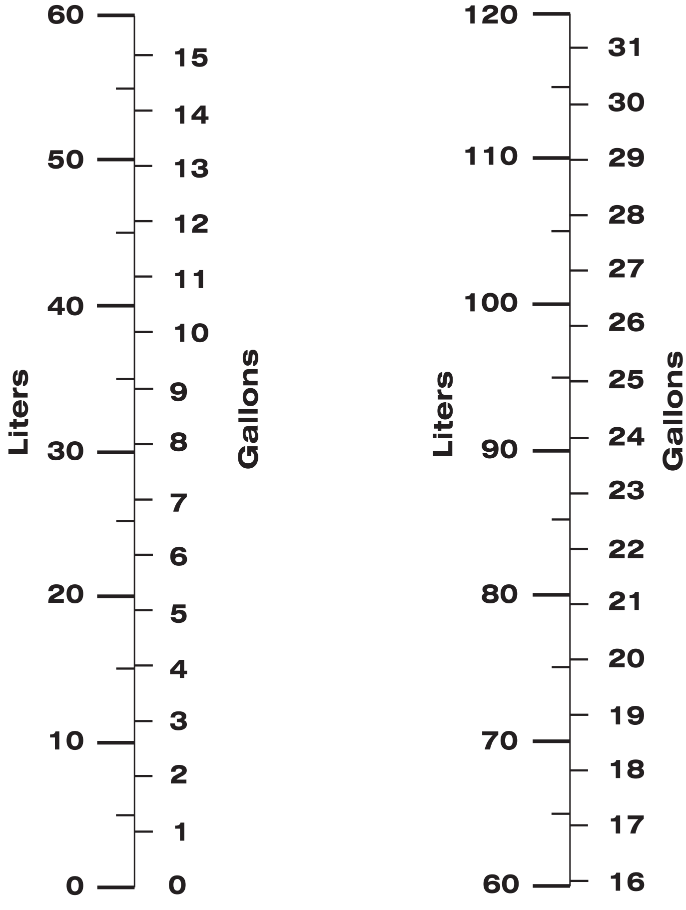


Figure 5-4

STALL SPEED

CONDITIONS:

POWER IDLE
WEIGHT 975 kg (2150 lbs) Most forward C.G. Position

CONDITIONS	STALL SPEEDS ~ KNOTS							
	ANGLE OF BANK							
	0°		30°		45°		60°	
	KIAS	KCAS	KIAS	KCAS	KIAS	KCAS	KIAS	KCAS
FLAPS 00°	60	59	65	64	72	71	85	84
FLAPS 20°	53	52	57	56	63	62	74	74
FLAPS 40°	51	50	55	54	61	60	71	71

NOTES:

1. THE MAXIMUM ALTITUDE LOSS DURING STALL RECOVERY CAN BE UP TO 250 FT.
2. AT MIDDLE AND AFT C.G. POSITIONS LOWER ABOVE SHOWN VALUES BY 1 KT.

EXAMPLE:

WEIGHT 975 kg (2150 lbs)
FLAPS 40°
ANGLE OF BANK 30°

STALL SPEED 55 KIAS
54 KCAS

Figure 5-5

TAKEOFF DISTANCE (FOR SHORT FIELDS)

CONDITIONS:

FLAPS 20°
TAKEOFF POWER SET BEFORE BRAKE RELEASE.
PAVED, DRY RUNWAY, ZERO WIND.

LIFT-OFF 58 KIAS
SPEED AT 50 ft 62 KIAS
WEIGHT 975 kg (2150 lbs)

PRESS ALT ft	ISA-10 °C		ISA		ISA+10 °C		ISA+20 °C		ISA+30 °C	
	GROUND ROLL ft	TOTAL TO CLEAR 50 FT OBS ft	GROUND ROLL ft	TOTAL TO CLEAR 50 FT OBS ft	GROUND ROLL ft	TOTAL TO CLEAR 50 FT OBS ft	GROUND ROLL ft	TOTAL TO CLEAR 50 FT OBS ft	GROUND ROLL ft	TOTAL TO CLEAR 50 FT OBS ft
MSL	1050	1378	1148	1476	1230	1591	1329	1690	1411	1788
1000	1115	1444	1214	1558	1312	1657	1394	1772	1493	1886
2000	1198	1542	1296	1640	1394	1755	1493	1870	1575	1985
3000	1312	1673	1427	1804	1526	1919	1624	2034	1722	2149
4000	1460	1837	1558	1952	1673	2083	1772	2198	1870	2329
5000	1575	1985	1690	2116	1804	2231	1903	2362	2001	2477
6000	1706	2133	1821	2264	1936	2395	2051	2526	2149	2657
7000	1854	2297	1969	2444	2083	2575	2182	2690	2297	2822
8000	2001	2477	2116	2608	2231	2740	2329	2871	2444	3002

NOTES:

1. THE TAKEOFF PROCEDURE FOR SHORT RUNWAYS IS DESCRIBED IN SECTION 4.
2. DECREASE DISTANCES BY 10% FOR EVERY 9 KNOTS OF HEADWIND. FOR OPERATION WITH TAILWINDS UP TO 10 KNOTS, INCREASE DISTANCES BY 10% FOR EVERY 2 KNOTS OF TAILWIND.
3. FOR OPERATION ON DRY, GRASS RUNWAY, INCREASE DISTANCES BY 10% OF THE GROUND ROLL FIGURE.

EXAMPLE:

WEIGHT	2150 lbs
AIR TEMPERATURE	21 °C
AIRFIELD PRESSURE ALTITUDE	2000 ft
HEADWIND COMPONENT	13.5 kts

READ VALUE AT ISA+10 °C BECAUSE THE STANDARD TEMPERATURE IN 2000 FT IS 11°C.
11°+10°=21 °C

GROUND ROLL	1394 ft
OVER A 50 FT OBSTACLE	1755 ft

THE CORRECTION FOR HEADWIND:

13.5 kts / 9 kts X 10% = 15% DECREASE

GROUND ROLL	1185 ft
OVER A 50 FT OBSTACLE	1492 ft

Figure 5-6

RATE OF CLIMB

CONDITIONS:

FLAPS 0°
FULL THROTTLE

WEIGHT lbs	PRESS ALT ft	CLIMB SPEED ~KIAS	RATE OF CLIMB ~ FT/MIN				
			ISA -10 °C	ISA	ISA +10 °C	ISA +20 °C	ISA +30 °C
2150	MSL	80	740	710	680	655	630
	2000	78	645	615	590	560	535
	4000	76	550	520	495	470	445
	6000	74	455	425	400	375	350
	8000	73	365	340	315	290	270
	10000	73	270	245	220	195	175
	12000	73	175	150	130	105	-
1830	MSL	80	995	965	930	900	870
	2000	78	890	860	830	800	770
	4000	76	790	755	725	700	670
	6000	74	685	655	625	600	570
	8000	73	590	560	535	510	485
	10000	73	485	460	430	410	385
	12000	73	380	355	330	310	285
	14000	73	270	250	225	205	185

NOTE: LEAN MIXTURE AS PER LYCOMING O-320 INSTRUCTIONS AT 5000 FT AND ABOVE.

EXAMPLE:

WEIGHT	1990 lbs
PRESSURE ALTITUDE	MSL
AIR TEMPERATURE	15 °C

THE EXAMPLE WEIGHT IS 50% OF THE DIFFERENCE BETWEEN 1830 LBS AND 2150 LBS. BETWEEN THE READ VALUES OF CLIMB RATES FOR GIVEN WEIGHTS, THE CORRESPONDING PERCENTAGE IS TO BE CONSIDERED.

CLIMB SPEED	80 KIAS
RATE OF CLIMB	838 ft/min

Figure. 5-7

TIME, FUEL, AND DISTANCE TO CLIMB

CONDITIONS:

WEIGHT 975 KG (2150 LBS)
FLAPS 0°
FULL THROTTLE

FUEL MIXTURE AS RECOMENDED BY LYCOMING
O-320 LEANING SCHEDULE
ZERO WIND, ISA

PRESSURE ALTITUDE ft	CLIMB SPEED KIAS	FROM SEE LEVEL			
		TIME min	FUEL USED l	FUEL USED U.S. GAL.	DISTANCE N.M.
1000	79	1,5	1,0	0,26	1,9
2000	78	3,0	2,2	0,58	4,0
3000	77	4,7	3,4	0,90	6,3
4000	76	6,6	4,6	1,21	8,7
5000	75	8,6	6,0	1,58	11,5
6000	74	10,9	7,4	1,95	14,5
7000	73	13,3	8,9	2,35	17,8
8000	73	16,1	10,6	2,80	21,5
9000	73	19,3	12,4	3,28	25,9
10000	73	23,2	14,5	3,83	31,0
11000	73	27,8	17,0	4,49	37,8
12000	73	33,7	20,0	5,28	46,6

NOTE:
1. ADD 4.0 l (APPROX. ONE GALLON) OF FUEL FOR START, TAXI AND TAKEOFF.
2. FOR TEMPERATURES ABOVE STANDARD, INCREASE VALUES BY 10% FOR EVERY 10 °C.

EXAMPLE:

DEP. AIRFIELD PRESSURE ALTITUDE	2000 ft
DEP. AIRFIELD TEMPERATURE	11 °C
CRUISE PRESSURE ALTITUDE	6000 ft

TIME:	10.9 min - 3 min	=	7.9 min.
FUEL:	1.95 - 0.58	=	1.37 U.S.Gal.
DIST.:	14.5 NM - 4 NM	=	10.5 NM

Figure 5-8

CRUISE PERFORMANCE

CONDITIONS:

WEIGHT 975 kg (2150 lbs)
ZERO WIND, ISA

LEAN MIXTURE UP TO 75% POWER FOR BEST ECONOMY AND ADJUST FULL RICH ABOVE 75%.

Pressure Altitude ft	RPM	Standard Temperature			
		%BHP	KTAS	l/h	U.S.GAL./h (Minimum)
2000	2700	92.5	128	48	12.7
	2600	83.8	123	43	11.4
	2500	75.6	118	33	8.7
	2400	70.0	114	31	8.2
	2300	60.0	107	26	6.9
	2100	53.8	101	24	6.3
	2000	41.3	88	18	4.8
4000	2700	84.4	128	43	11.4
	2600	78.1	123	40	10.6
	2500	70.0	118	31	8.2
	2400	65.6	114	29	7.7
	2300	56.9	107	25	6.6
	2100	50.6	101	22	5.8
	2000	40.0	88	18	4.8
6000	2700	81.3	128	42	11.1
	2600	72.5	123	32	8.5
	2500	66.3	118	29	7.7
	2400	60.0	114	26	6.9
	2300	53.8	107	24	6.3
	2100	47.5	101	21	5.5
	2000	38.1	88	17	4.5
8000	2700	73.8	128	32	8.5
	2600	67.5	123	30	7.9
	2500	61.9	118	27	7.1
	2400	56.9	114	25	6.6
	2300	50.0	107	22	5.8
	2100	45.6	101	20	5.3
	2000	36.9	88	16	4.2

Figure 5-9(1)

CRUISE PERFORMANCE (Continued)

Pressure Altitude ft	RPM	Standard Temperature			
		%BHP	KTAS	l/h	U.S.GAL./h (Minimum)
10000	2700	-	-	-	-
	2600	63,1	123	28	7.4
	2500	56,9	118	25	6.6
	2400	53,8	114	24	6.3
	2300	46,9	107	21	5.5
	2100	43,1	101	19	5.0
	2000	35,0	88	15	4.0
12000	2700	-	-	-	-
	2600	59,4	123	26	6.9
	2500	53,8	118	24	6.3
	2400	50,0	114	22	5.8
	2300	44,4	107	19	5.0
	2100	40,6	101	18	4.8
	2000	34,4	88	15	4.0

EXAMPLE:

WEIGHT	975 kg (2150 lbs)
TEMPERATURE	7 °C
PRESSURE ALTITUDE	4000 ft
ENGINE SPEED	2400 RPM
% BHP	65%
TRUE SPEED	114 KTAS
MIN. FUEL CONSUMPTION	29 l/h (7.7 U.S. Gal. /h)

Figure 5-9(2)

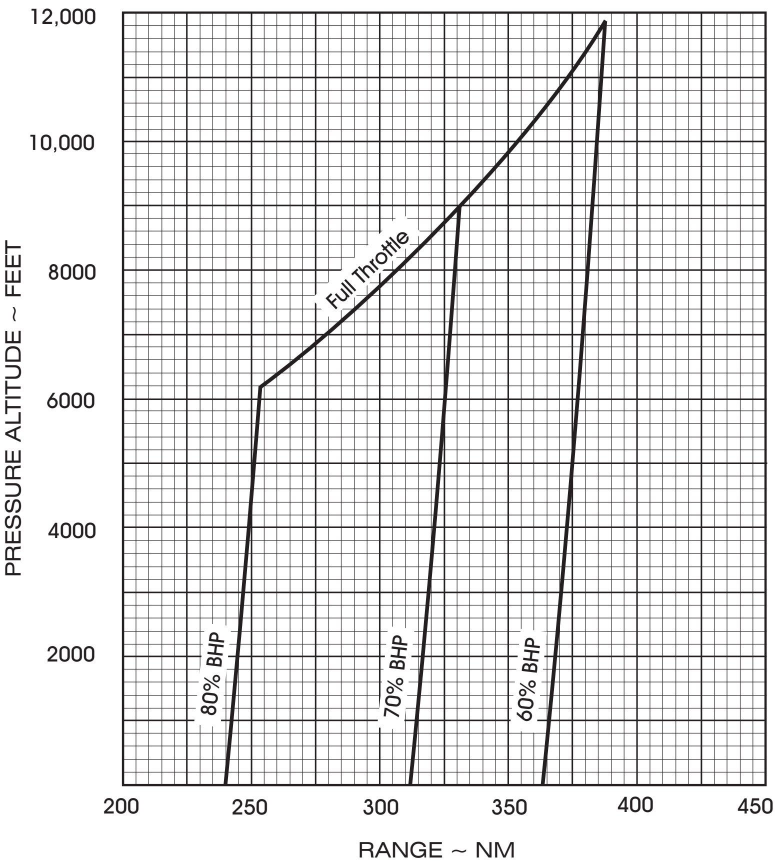
BEST RANGE PROFILE

CONDITIONS:

WEIGHT 975 kg (2150 lbs), INITIAL FUEL LOADING 110 LITERS (29.1 U.S.GAL.) USABLE

ZERO WIND, ISA

LEAN MIXTURE UP TO 75% POWER FOR BEST ECONOMY AND ADJUST RICH ABOVE 75%.



NOTE:

RANGE INCLUDES START, TAXI, CLIMB AND DESCENT WITH 45 MINUTES RESERVE FUEL AT MAXIMUM RANGE POWER.

Figure 5-10

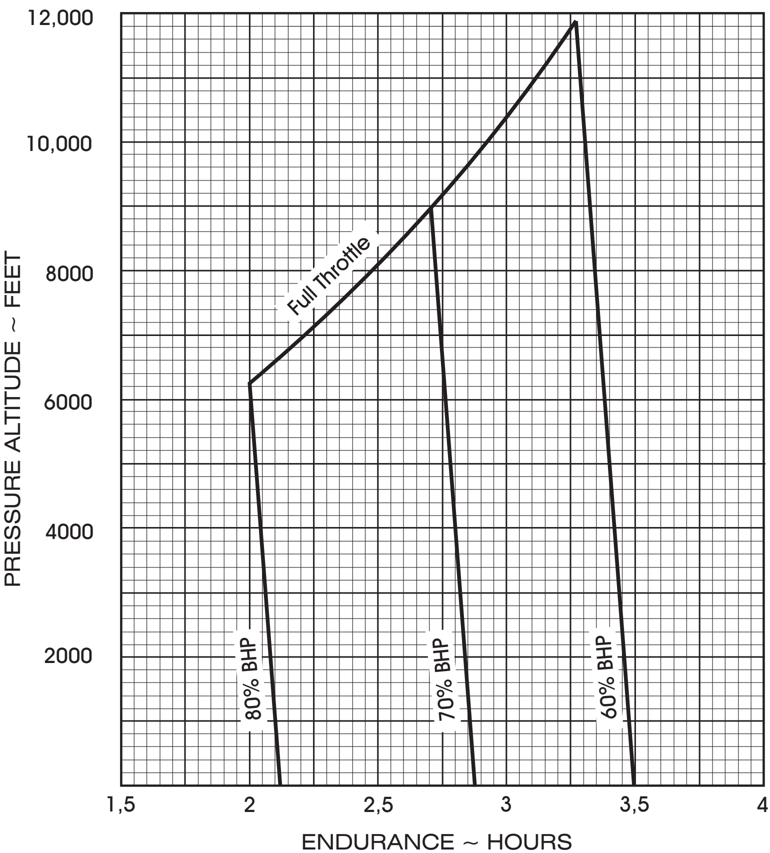
ENDURANCE PROFILE

CONDITIONS:

WEIGHT 975 kg (2150 lbs), INITIAL FUEL LOADING 110 LITERS (29.1 U.S.GAL.)USABLE

ZERO WIND, ISA

LEAN MIXTURE UP TO 75% POWER FOR BEST ECONOMY AND ADJUST FULL RICH ABOVE 75%.



NOTE:

ENDURANCE INCLUDES FUEL FOR START, TAXI, CLIMB AND DESCENT WITH 45 MINUTES RESERVE AT CRUISE POWER, AND TIME FOR CLIMB.

Figure 5-11

LANDING DISTANCE (FOR SHORT FIELDS)

CONDITIONS:

WEIGHT 975 kg (2150 lbs)
FLAPS 40°

APPROACH SPEED AT 50 FT 65 KIAS
PAVED, DRY RUNWAY, ZERO WIND

Pressure Altitude ft	ISA-10 °C		ISA		ISA+10 °C		ISA+20 °C		ISA+30 °C	
	Total to Clear 50 ft OBS ft	Ground Roll ft	Total to Clear 50 ft OBS ft	Ground Roll ft	Total to Clear 50 ft OBS ft	Ground Roll ft	Total to Clear 50 ft OBS ft	Ground Roll ft	Total to Clear 50 ft OBS ft	Ground Roll ft
MSL	2182	869	2280	902	2346	935	2395	968	2461	1001
1000	2264	902	2329	935	2395	968	2461	1001	2526	1033
2000	2313	935	2379	968	2444	1001	2510	1033	2575	1066
3000	2379	951	2444	984	2510	1033	2575	1066	2641	1099
4000	2428	984	2493	1017	2575	1066	2641	1099	2707	1132
5000	2493	1017	2559	1050	2641	1083	2707	1132	2789	1165
6000	2543	1050	2625	1083	2707	1132	2772	1165	2854	1198
7000	2608	1083	2690	1115	2772	1165	2854	1198	2936	1247
8000	2674	1115	2756	1148	2838	1198	2936	1247	3018	1280

NOTES:

1. THE LANDING PROCEDURE FOR SHORT FIELDS IS DESCRIBED IN SECTION 4.
2. DECREASE DISTANCES BY 10% FOR EVERY 10 KNOTS OF HEADWIND. FOR OPERATION WITH TAILWINDS UP TO 10 KNOTS, INCREASE DISTANCES BY 10% FOR EVERY 2 KNOTS.
3. INCREASE GROUND ROLL ON DRY GRASS SURFACE BY 35%.
4. FOR EACH DEGREE OF RUNWAY SLOPE INCREASE GROUND ROLL BY 15%.
5. WITH FLAPS UP (V_{APP}74 KIAS), INCREASE LANDING DISTANCE BY 45%.

EXAMPLE:

WEIGHT	2150 lbs
AIR TEMPERATURE	33 °C
AIRFIELD PRESSURE ALTITUDE	1000 ft
HEADWIND COMPONENT	10 kts

READ VALUE AT ISA+20 °C BECAUSE THE STANDARD TEMPERATURE IN 1000 FT IS 13 °C. 13°+20°=33 °C

TOTAL OVER 50 FT OBSTACLE	2461 ft
GROUND ROLL	1001 ft

THE CORRECTION FOR HEADWIND:
10 kts/10 kts x 10% = 10% DECREASE

TOTAL OVER 50 FT OBSTACLE	2215 ft
GROUND ROLL	901 ft

Figure 5-12

SECTION 6

WEIGHT AND BALANCE / EQUIPMENT LIST

TABLE OF CONTENTS

Page

6.1 GENERAL

This section provides information to determine the aircraft weight and center of gravity. The performance and flying characteristics of the SA 160 aircraft can only be achieved if it is flown within the approved weight and Center-of-Gravity (C of G) envelope. In addition, flight operation outside of the approved weight and C of G envelope will have a negative impact on the aircraft flight characteristics and represent a significant risk to the aircraft and its occupants.

WARNING !

It is the responsibility of the pilot in command to ensure the aircraft is loaded properly and operated within the prescribed weight and C of G envelope. Operation outside of the authorizedweight and balance limitations could cause an accident to occur.

The following sections provide information on how to determine the aircraft weight and center of gravity for safe aircraft operation.
Specific information regarding the weight, moment arm of installed equipment for the SA 160 can be found in the aircraft equipment list provided with the aircraft technical records at the time of aircraft delivery.

6.3 AIRCRAFT WEIGHING PROCEDURE

At the time of delivery, Symphony Aircraft Industries provides for each aircraft the basic empty weight and center of gravity location. This data is provided on the Weight and Balance Data Form shown in Figure (6.1). The removal or addition of equipment will affect the basic empty weight and center of gravity position. As such, a weight and balance amendment or a new aircraft weight and balance will need to be performed.

The following procedure must be followed prior to weighting the aircraft;

(a) Preparation

(1) Verify the aircraft equipment against the provided equipment.. list to ensure that the list is complete and that all equipment is installed in its proper location.
(2) Remove all foreign items from aircraft.
(3) Defuel aircraft, drain all remaining fuel, and add the unusable fuel again. Refer for the proper procedure in the “SA 160 Maintenance Manual, "Chapter 12 SERVICING".
(4) Remove excessive dirt or moisture.
(5) Top up engine oil as required to the max. oil level (7,6 liter/8qt).
(6) Adjust the seats to the maximum forward position.
(7) Retract the flaps completely.
(8) Put all control surfaces in the neutral position.

CAUTION !

Whenever the fuel system is completely drained and fuel is replenished, it will be necessary to run the engine for a minimum of three (3) minutes at 1000 RPM in order to ensure that no air remains in the fuel supply lines

(b) Leveling

(1) Place properly calibrated scales with the corresponding load-carrying capacity under each wheel.
(2) Using the aircraft marking for longitudinal leveling shown in Figure (6.2) level the aircraft by changing the air pressure in the nose wheel tire to center the bubble on a spirit level.

(c) Weighing Aircraft Basic Empty Weight

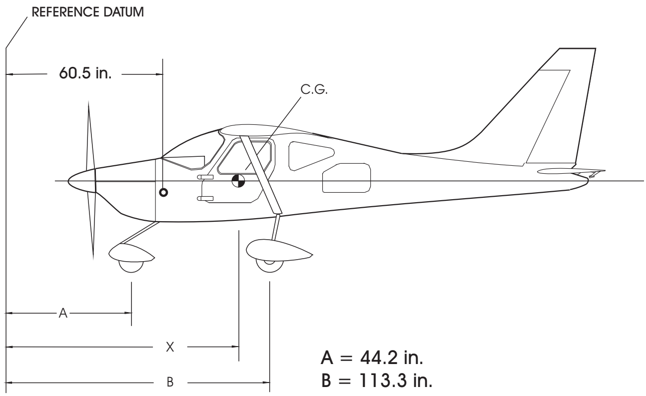
(1). With the airplane level and brakes released, record the weight shown on each scale. From the scale calibration data, deduct the tare weight, if any, from each reading. Enter values into the weight data form of Figure (6.1).

* The standard empty weight includes the required oil level (7.6 liters / 8 qt.) and 12 liters (3.1 US Gal.) unusable fuel.

AIRCRAFT WEIGHING FORM

MODEL:	SERIAL NUMBER:	REGISTRATION NUMBER:	DATE:

LEVELING DIAGRAM



AIRCRAFT AS WEIGHED

POSITION - SYMBOL	SCALE READING	SCALE ERROR	NET WEIGHT ~lbs
NOSE WHEEL - N			
RIGHT MAIN WHEEL - R			
LEFT MAIN WHEEL - L			
AIRCRAFT TOTAL AS WEIGHED			

Empry Weight We;
We = N + L + R

Center of Gravity C of G_{We};
$$C \text{ of } G_{We} = \frac{N(A) + (R+L)(B)}{We}$$

Empty Weight Me;
Me = We x C of G_{We};

BASIC EMPTY WEIGHT AND C. G.

ITEM	WEIGHT ~ lbs	C.G. ARM ~ in.	MOMENT ~ in-lbs
BASIC EMPTY WEIGHT			

* The standard empty weight includes the required oil level (8quarts) and 2.4 US Gal. unusable fuel.

Figure 6-1

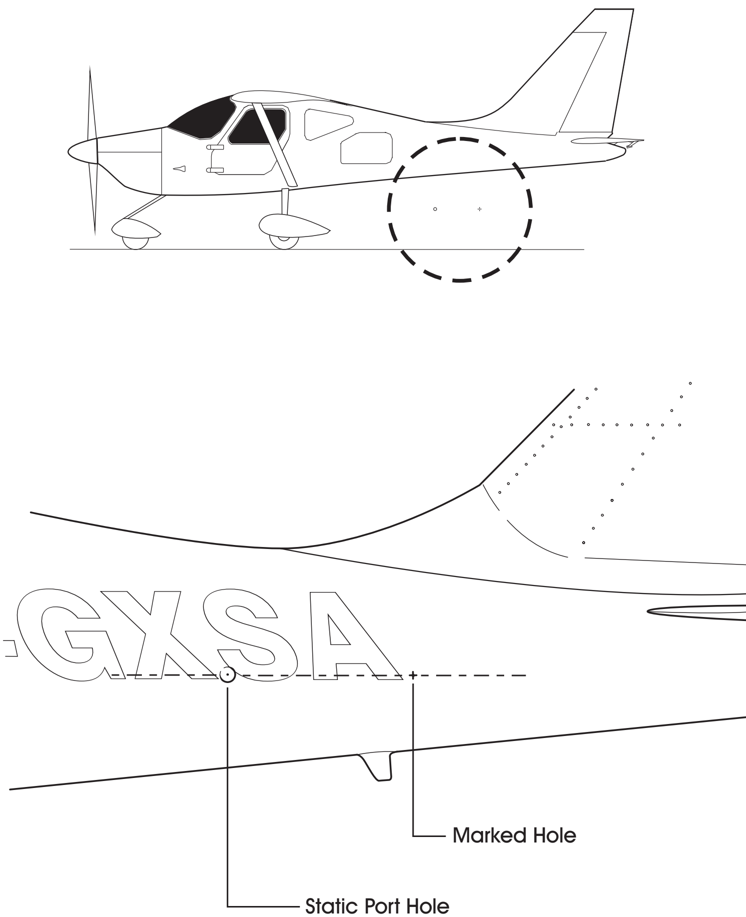


Figure 6-2
Markings for Aircraft Longitudinal Leveling

(d) Basic Empty Weight Center of Gravity

(1) The basic empty weight We (as weighed including equipment noted in the equipment list, required oil level and unusable fuel) is given by:

$We = N + L + R$

where;

N = Nose wheel net weight (lbs)
R = Right main wheel net weight (lbs)
L = Left main wheel et weight (lbs)

(2) The center of gravity C of G_{We} corresponding to the basic aircraft empty weight is given by;

$$C \text{ of } G_{We} = \frac{N(A) + (R+L)(B)}{We}$$

where;

A = Distance from nose wheel from reference datum 44.2 In.
B = Distance from right and left main wheel from reference datum 113.2 In.

(3) The empty weight moment Me corresponding to the basic aircraft empty weight and C of G_{We} is given by;

$Me = We \times C \text{ of } G_{We}$

This data is provided for each SA 160 at time of delivey.

WEIGHT AND BALANCE RECORD

(Continuous History of Changes in Structure or Equipment Affecting Weight and Balance)

AIRCRAFT MODEL:				SERIAL NUMBER:					REGISTRATION NUMBER:		
BASIC EMPTY WEIGHT:					C of G_{We}				BASIC MOMENT:		
DATE	ITEM		DESCRIPTION OF ARTICLE OR MODIFICATION	WEIGHT CHANGE						RUNNING BASIC EMPTY WEIGHT	
				ADDED (+)			REMOVED (-)				
	"+"	"-"		WEIGHT (lbs)	ARM (in.)	MOMENT (in-lbs)	WEIGHT (lbs)	ARM (in.)	MOMENT (in-lbs)	WEIGHT (lbs)	MOMENT (in-lbs)
BASIC EMPTY DATA:											
REVISE DATA											
EMPTY WEIGHT:					C of G:				MOMENT:		

Figure 6-3

6.5 WEIGHT AND BALANCE DETERMINATION AND RECORD

The basic empty weight and center of gravity location data, as provided in the Aircraft Weight Form (See Figure 6.1) was determined when the aircraft was delivered at the factory. This information can be applied only to the specific aircraft serial number and registration number shown on the form.

The same values, basic empty weight, moment and C of G_{We} are listed in the first line of the Weight and Balance Record shown in Figure (6.3). This form is provided to track the current status of the aircraft basic empty weight after the addition of new equipment or aircraft modifications. Once completed this form provides the new basic weight information required for any in-flight loading calculation. The form also provides a complete history of all modifications, which affects weight or moment and is used to amend the basis empty weight and balance data.

6.7 WEIGHT AND BALANCE DETERMINATION FOR FLIGHT

The following procedure will enable the determination of the aircraft weight and C of G position for flight operation. The results obtained must be compared with the authorized weight and C of G envelope to ensure that the aircraft operation is within the prescribed limits. It is recommended that the SA 160 Weight and Balance Loading Form provided as Figure (6.4) be used to perform the calculation.

(a) Enter the weight of all items to be loaded in the weights and balance loading form of Figure (6.4), and add each item to the basic empty weight. Write the aircraft total weight at the bottom of the table.

(b)Determine the moment of all items to be carried by using the graph provided as Figure (6-5), or by multiplying the weight of each item by the moment arms provided in Figure (6.6). Enter the arm and moment data into the loading form. Add all resulting moment arm for each item to the empty weight moment. Write the aircraft total moment at the bottom of the table.

(c)Divide the total moment by the total weight to determine the aircraft new C of G location

.

(d)In (a) and (c) plot the weight and C of G values on the graph "Weight and Moment Limits" provided as Figure (6.7), to ensure that the point falls within the envelope, and the intended weight and C of G loading is permissible.

WEIGHT AND BALANCE LOADING FORM

	WEIGHT lbs	ARM in.	MOMENT in-lbs/100
Basic Empty Weight			
Pilot and Passenger			
Fuel (Usable)			
Baggage 1			
Baggage 2			
Ramp Weight			
Fuel for Engine Start, Taxi and Runup			
Total Loaded Aircraft (T)			

Figure 6-4

LOADING GRAPH

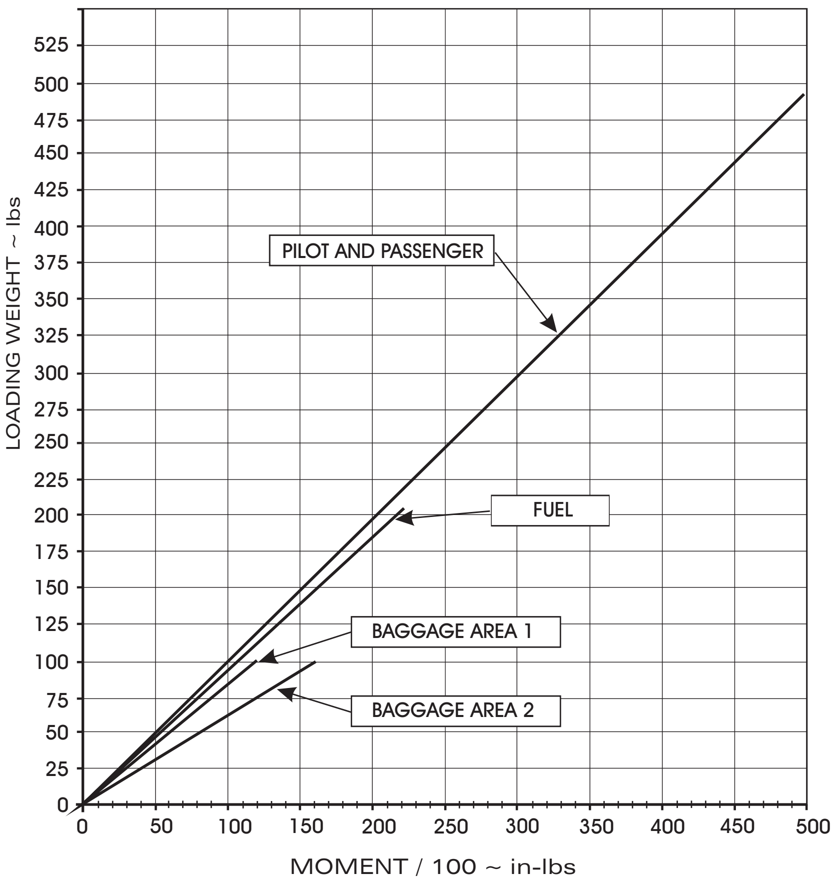


Figure 6-5

MOMENT ARM

ITEM	MOMENT ARM (in)
Pilot Passenger	101.2
Baggage #1	122.8
Baggage #2	159.1
Fuel (Usable)	107.4

Figure 6-6

WEIGHT AND MOMENT LIMITS

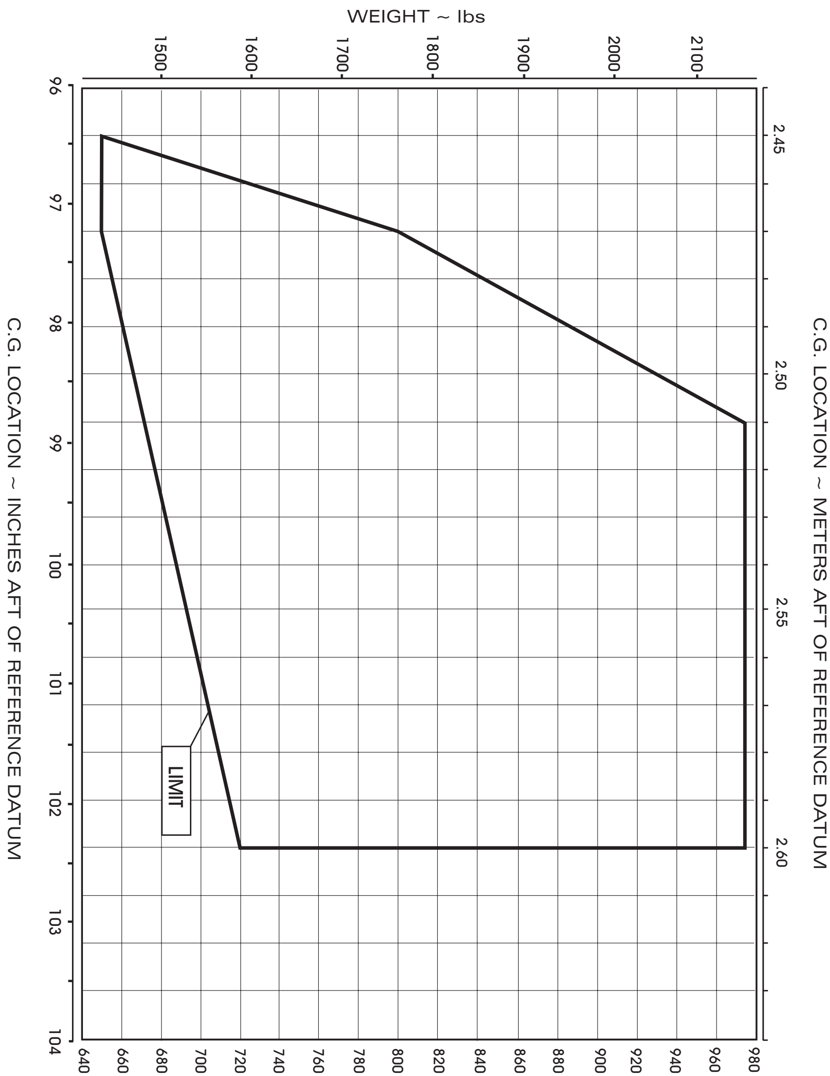


Figure 6-7

6.8 WEIGHT AND BALANCE EXAMPLE

The following example is provide as a guide for weight and balance calculation and does not reflect a specific aircraft. The weight and balance data specific to each aircraft must be performed before each flight.

Assuming the following basic data we have:

Basic empty weight :	1470 Lbs
Empty weight moment:	1449.32 in-lbs/100
C of G (Empty):	98.6Iinches

From the following aircraft loading information we have:

Pilot:	200 lbs
Passenger:	185 lbs
Baggage area #1:	60lbs t HE
Baggage area #2:	40lbs
Fuel:	20 USG

Using the Weight and Balance Loading Graph of Figure (6.4) and the data of Figures (6.5) and (6.6) we obtain the weight and balance data shown in Figure (6.8).

In the example the center of gravity location at take-off is found to be:

$$C \text{ of } G_{T/O} = 199510 \text{ in-lbs}/1966. \text{ lbs}$$
$$= 101.5 \text{ in}$$

This point is found to be within the envelope of the graph “Weight and Moment Limits” of Figure (6.7). Hence one can find that it lies in the permissible range and therefore the planned loading is permissible.

WARNING !

The data provided in Figure (6.7) is provided in both inches/pounds and in meters/kilograms. One should ensure that consistent units are used throughout the calculation.

	WEIGHT lbs	ARM in.	MOMENT in-lbs/100
Basic Empty Weight	1470	98.6	1449.32
Pilot and Passenger	385	101.2	389.62
Fuel 30.1 Gallons Usable	120	107.4	128.08
Baggage 1	60	122.8	73.68
Baggage 2	40	159.1	63.64
Ramp Weight	2075	101.45	2105.14
Fuel for Engine Start, Taxi and Runup	-8.8	107.4	-9.45
Total Loaded Aircraft	2066.2	101.42	2095.65

Figure 6-8

6.9 EQUIPMENT LIST

The equipment list applicable to a particular aircraft serial number is included in the Serialized Equipment List is provided with the aircraft Technical Log at delivery.

SECTION 7

DESCRIPTION AND OPERATION OF THE AIRCRAFT AND ITS SYSTEMS

TABLE OF CONTENTS

Page

TABLE OF CONTENTS (CONTINUED)

TABLE OF CONTENTS (CONTINUED)

Fig.

INTENTIONALLY LEFT BLANK

7.1 GENERAL

This section describes the operation of the aircraft with its equipment and its systems. The user should become familiar with the aircraft system operation to ensure optimal and secure usage of the aircraft.
The content of this section refers to a standard SA 160 aircraft. Description and operation of optional equipment is described in the Section 9 under “SUPPLEMENTS“.

7.3 AIRCRAFT

The SA 160 is a single engine, high wing aircraft equipped with fixed tricycle landing gear and designed for general utility operation.

The cabin provides comfortable side-by-side seating for two people with dual flight control. A spacious baggage compartment is located behind the seats with access through the baggage door. A wide windshield, large convex door windows as well as windows in the top of the cabin ensure very good visibility. Entry to, and exit from the aircraft is effected through a door on each side of the cabin.

The rectangular wings are dihedral and strut braced. Fowler flaps extend from the trailing edge up to the ailerons, and along to the wing tips. At the outboard portion of each wing, on the top side, two Vortex Generators are installed. They increase the effectiveness of the ailerons at high angle of attack near the aircraft stall.

The otherwise conventionally designed empennage, contains strakes on the horizontal stabilizer leading edge.

The control surfaces of the aircraft are operated utilizing cables, pulleys and push roads. The flaps are operated electrically. An elevator trim tab

is operated manually.

All three wheels of the landing gear are equipped with fairings. The wheels of the main landing gear have hydraulically actuated disc type brakes.
The SA 160 is powered by the proven and reliable engine of the manufacturer Textron Lycoming, model O-320-D2A, with a fixed two-bladed propeller.

The modern design and materials used in this aircraft forms the basis for very good flight characteristics, performance, secure operation, and serviceability. Special features such as the strakes and the vortex generators improve the aircraft handling characteristic at the edge of the flight envelope.

7.5 AIRFRAME

The SA 160 airframe uses well proven aerospace design concepts as well as high quality fabrication techniques with distinct advantages for servicing procedures, strength, durability and safety.

The primary structure of the fuselage is a welded high-strength 4130 steel tube cage, which is enveloped by two, non-structural, fiberglass shell half that run from the cowl split line to the tail cone.
The engine mount and nose gear strut attach to the front section of the tube cage

At the upper mid fuselage areas are the wing attachment points, and at the bottom, the leaf spring steel struts of the main landing gear and the wings struts attachments. The fuselage cage ends in the tail cone.
The fuselage cage carries all the in-service loads. The welded cage structure also provides an exceptional degree of crash worthiness.

The wings are typical aluminum skin, spar and rib construction. They are equipped with fowler flaps and ailerons. Aluminum alloys are

exclusively used in the wings, flaps and ailerons. One piece fore and aft spars are made of extruded aluminum construction to carry bending and torsion loads. At the roots, they are attached by removable bolts to the fuselage cage.

Attached to the aft spar are the flap tracks, the aileron hinges and the bearings for pulleys and bell cranks. The wing strut ties into a reinforced rib beam, which spans between fore and aft spars.
Welded aluminum fuel tanks are fitted into the first main bay at the root of the wings. Filler cups, vents and drains are provided in each tank.
Ailerons are actuated via control cables and bell cranks with push rods. The ailerons are mass balanced.
The fowler flaps are actuated by an electric flap actuator that is installed in the left wing structure.
The tail control surfaces are also of conventional aluminum construction. The vertical tail has a vertical stabilizer and a rudder with aerodynamic and mass compensation at the top end.
The rudder is connected to the vertical stabilizer by three hinged brackets. The lower one has a yoke that drives the rudder by means of control cables.
The horizontal tail has a stabilizer and an elevator. The elevator is attached to the stabilizer by piano-type hinges and is driven by a pushrod at the center of the elevator base. The elevator has a trim tab, which is attached to the trailing edge (starboard side). The elevator is aerodynamic and mass balanced at the tips.

7.7 FLIGHT CONTROLS

The aircraft is equipped with dual controls.
The ailerons and the elevator are operated by the control stick, and the rudder by foot pedals in front of each seat, via a system of control cables, pulleys and turnbuckles. (See Fig. 7-1, 7-2 and 7-3)
The trim-tab serves the dual function of providing trim control and pitch control forces. The trim tab is actuated by a trim control wheel located on the control console between the seats. Forward rotation of the wheel gives nose down trim and aft rotation gives nose up trim.

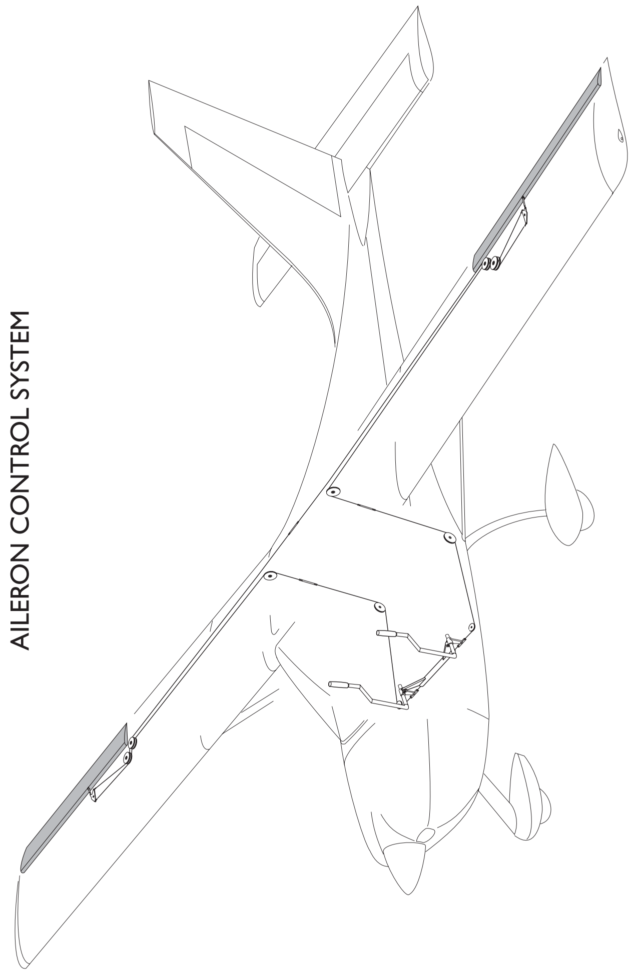


Figure 7-1
Aileron Control System

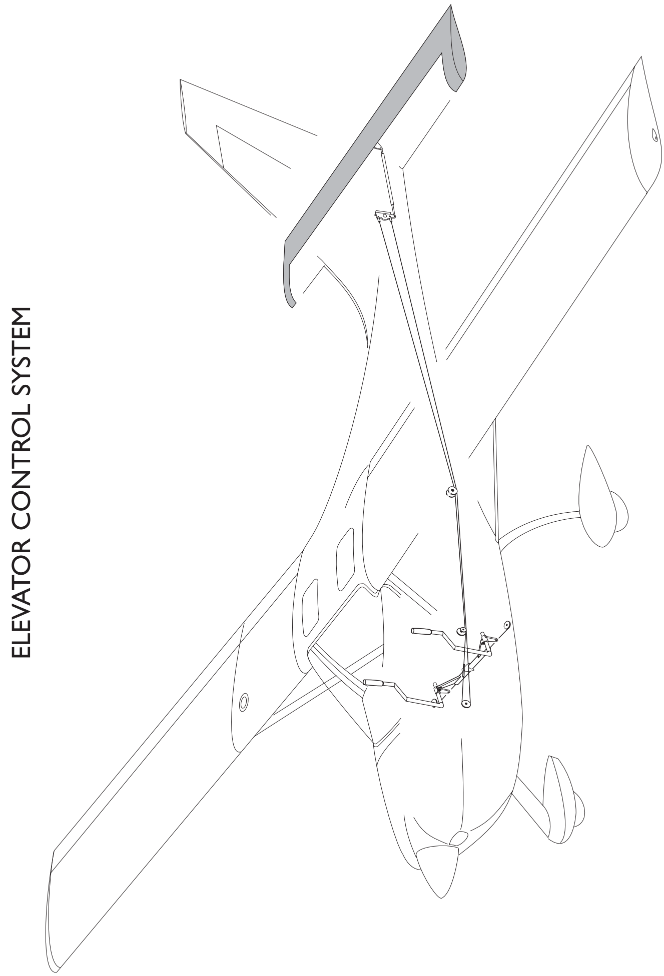


Figure 7-2
Elevator Control System

RUDDER CONTROL SYSTEM

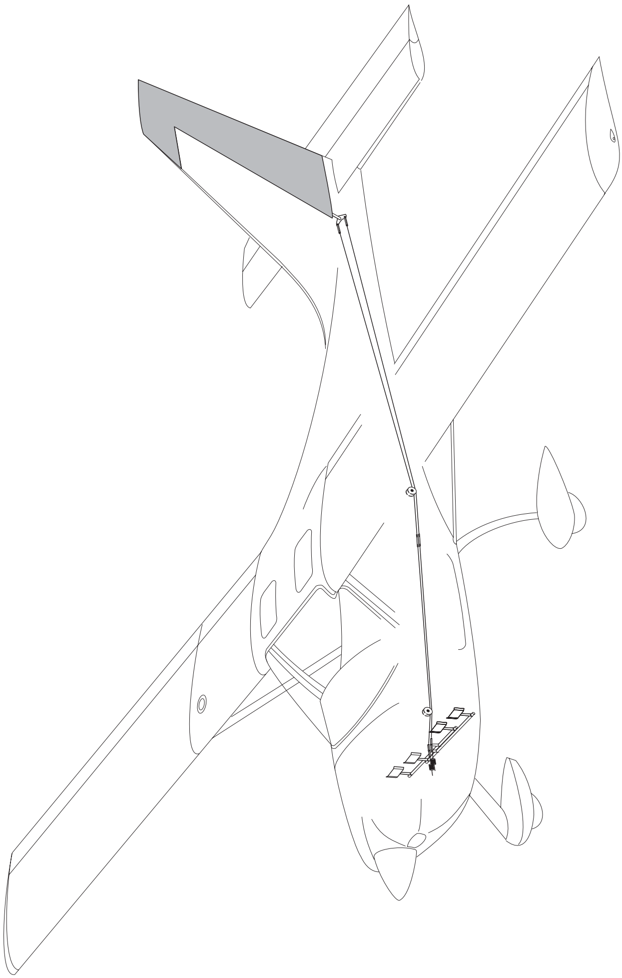


Figure 7-3
Rudder Control System

7.9 INSTRUMENT PANEL

The instrument panel of the SA 160 is shown in Fig. 7-4.
For an easy and quick reference, the instruments and controls are clearly divided in three sections: left centre and right sections

The left section is comprised of a group of six flight instruments located in front of the pilot (for further details se Fig 7-4). Below the flight instrument is a row of switches for system command.

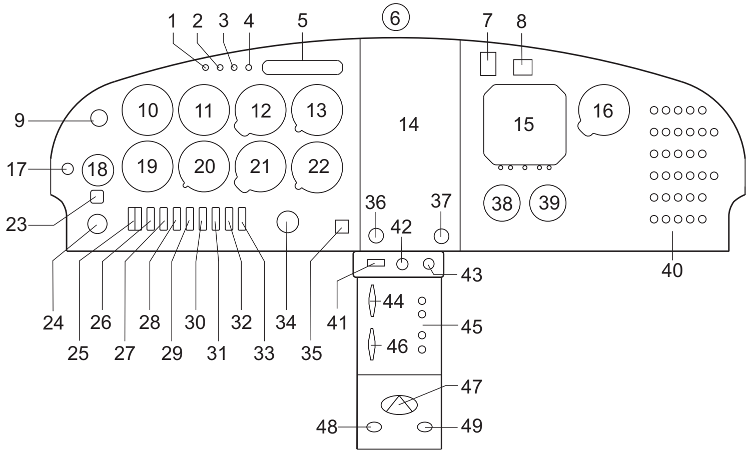
The middle section of the panel contains the avionics equipment. The avionics equipment type is depended upon the configuration of the aircraft (i.e. VFR or IFR version). Below the avionics equipment is the throttle, mixture and carburetor heat.

On the center console pedestal is located the flap switch and next to it the light dimmer switches. On the lower part of the pedestal are the heat controls, the fuel shut-off valve, the primer and the parking brake control buttons.

The VM 1000 Engine Management System indicator is on the right side of the avionics column. It shows the manifold pressure, the engine speed, oil temperature, oil pressure, cylinder head temperature, exhaust gas temperature, fuel pressure, as well as alternator output amperage and voltage of the electrical system. The circuit breaker panel is located on the extreme right side of the panel.

7.11 FLIGHT INSTRUMENTS

Flight instruments are standard and arranged around the basic “T” configuration. Those are the airspeed indicator (top left), the attitude indicator (top), the altimeter (top right), the turn coordinator (lower left), the directional gyro (center below) and the vertical speed indicator (lower right).



1 Annunciator for Fuel Pump Operation (green)
2 "FLAPS IN MOTION" Annunciator (yellow)
3 "PITOT HT Inop"(IFR) (yellow)
4 "EXT PWR" (yellow)
5 EC 100 Display
6 Magnetic Compass
7 ELT (optional)
8 Hour Meter
9 Suction Gauge
10 Air Speed Indicator
11 Attitude Indicator
12 Altimeter
13 CDI (IFR)
14 Reserved
15 Avionics
16 VM 1000 Display
17 Alt. Static Source Valve (IFR)
18 Clock
19 Turn Indicator
20 Directional Gyro
21 Vertical Speed
22 CDI (optional)
23 Clock Switch (optional)
24 Ignition Switch
25 ALT / BAT Ext P-Schalter
26 Fuel Pump Switch
27 Avionik 1 Switch
28 Avionik 2 Switch (IFR)
29 Pitot Heat Switch
30 Strobe Light Switch
31 Navigation Light Switch
32 Landing Light Switch
33 Dome Light Switch
34 Flap Position Indicator
35 Carburator Heat Control
36 Throttle
37 Mixture Control
38 Fuel Level Indicator
39 OAT/CAT Indicator (optional)
40 Circuit Breakers
41 Flap Switch
42 Dimmer Switch for Instrument Lights
43 Dimmer Switch for Map Lights
44 Heated Air Distributor Control
45 Headset Jacks
46 Cabin Heat Control
47 Fuel Shut-Off Valve
48 Primer Pump (optional)
49 Parking Brake (optional)

Figure 7-4
Instrument Panel

INTENTIONALLY LEFT BLANK

7.13 GROUND CONTROL

The directional control of the aircraft on the ground is accomplished by differential breaking of the main gear wheels. The brakes are actuated by pushing the upper part of the appropriate rudder pedal.
Use of the right brake pedal has a breaking effect on the right main gear wheel and will steer the nose to the right. Use of the left brake pedal has a braking effect of the left main gear wheel and will steer the nose to the left. The braking force depends upon the intensity of the pressure applied to the brake pedals.

Because the nose wheel fork can rotate, the front wheel will pivot and turn in the direction of the directional control applied through the brakes and rudder. To decelerate the aircraft in a straight line, a uniform pressure should be applied simultaneously to both brake pedals.

CAUTION !

Before every takeoff, and landing, ensure that the feet of the non flying individual are clear of the brakes and rudder pedals.

7.15 WING FLAP SYSTEM

The SA 160 employs electrically actuated Fowler flaps, which can be extended from 0°- 40° without increments.
The left flap is directly connected to an electrical flap actuator through a bellcrank and a pushrod. The right flap is driven through control cables, a bellcrank and a pushrod.
The flap position indicator is located on the instrument panel right to the row of control switches.

From the retracted position the flaps are extended by pressing and holding the flaps switch until the desire flap deflection is achieved. A limit switch on the actuator will stop the flaps movement when the flaps reach the 40° position.

To retract the flaps, the flaps switch must be placed in the upper position from the neutral position. The switch will remain in the upper position until reset to neutral. After the complete or partial flaps retraction, the flaps switch is to be set into neutral position. A micro switch will stop the full flaps retraction at the 0° setting.

A yellow annunciator light, “Flaps in Motion”, indicates that the flaps are in transition. The light is located beside the EC 100 Display, above the flight instruments (Figure 7-2).
The light will illuminate, whenever the flap actuator is in operation. The purpose of this light is to inform the pilot when the actuator is in operation. If the light remains ON when the flaps are fully extended or retracted that there is likely an actuator problem that needs to be investigated.

7.17 LANDING GEAR

The aircraft has a fixed tri-cycle landing gear. All three wheels are equipped with an aerodynamic wheel fairing to reduce drag.
The main gear struts are cantilever leaf springs, which are mounted at the bottom of the fuselage cage. Hydraulically actuated disc type brakes are fitted to the inboard side of the main gear wheel.
The nose gear strut consists of a spring steel tube with a turnable wheel fork. Nose gear shock absorption is provided by a rubber disc shock absorber unit mounted on the truss structure of the fore fuselage cage.
The tire sizes for all three wheels are 5.0“x 5.0”.
At maximum gross weight, a tire pressure of 2,87 bars (41 psi) for the nose wheel, and 2,5 bars (36 psi) for the main wheels is required.

7.19 BAGGAGE COMPARTMENT

The baggage compartment in the SA 160 is located behind the seats. A baggage door is provided on the left side of the aircraft just behind the pilot's door.
During flight the baggage should be properly secured at all time. For this purpose four cargo tie-downs located on the baggage compartment floorboard and two small cargo nets are provided.
Maximum weight in the baggage compartment is limited to 165 lbs. (75 kg) however the maximum baggage compartment floor load for each baggage area (red marking) is limited to a maximum of 99 lbs (45 kg).

WARNING !

Do not place any small loose articles in the baggage compartment. All baggage must be stowed in containers such as packs, suitcases or bags to avoid potential injuries in the event of a forced landing.

7.21 SEATS AND SEAT BELTS

The aircraft cabin provides side-by-side seating for two. The seats are adjustable fore and aft. To position the seat, lift the handle located below the seat frame, slide the seat into position, and release the handle. Ensure that the seat is locked into position.
The seats are equipped with automatic, four point seat belts/shoulder harness assemblies. To fasten the seat belts/shoulder harness a center link is used. The design incorporates an inertia reel system for the shoulder portion. The shoulder harnesses are attached to the cage truss structure behind the seats, and allows for complete freedom of movement of the upper torso area. In the event of a sudden deceleration, the reels lock up to provide positive restraint for the user.

7.23 DOORS AND WINDOWS

The SA 160 has two cabin doors. Each door is secured by a three-point latch system actuated by an interior and exterior door handle on each cabin door.
To close the door from inside the airplane, pull the door shut, and push the door locking handle forward into the locked position.
The door handle is spring loaded to the close position. To open the door from inside pull the door handle aft to the open position.

To open the door from the outside, utilize the recessed door handle by pressing onto the round part of the handle, pulling the handle outward, and then turning it down. The doors open fully forward. The doors and the baggage compartment can be locked with a key from the outside.

The windshield, door and cabin roof windows are produced of polyacryl and bonded to the door and fuselage shell structure. They cannot be opened. For cleaning and care of the windows refer to section 8 of this manual.

7.25 ENGINE

The aircraft is powered by an air-cooled, four-cylinder, direct-drive, horizontally opposed gasoline engine with wet sump lubrication. The engine is a Lycoming Model O-360-D2A and is rated at 119 KW (160HP) at 2700 RPM.
The engine is mounted at four points on a steel tube engine mount via dynafocal mounts.
The engine is equipped with: A single barrel float-type carburetor with manual mixture control and an idle cut-off on the bottom of the engine, a starter motor (front lower left), a belt driven 70A-28V DC-alternator (front right), a dual ignition system with two magnetos (rear), a vacuum pump to provide suction for the gyro instruments, and a fuel pump mounted on the rear of the engine accessory case.

For maintenance and repairs the engine cowling consists of an upper and lower half fiberglass shell that can be removed.

In order to obtain maximum efficiency and time between overhauls, the pilot should familiarize himself and follow the procedures recommended in the Lycoming Operator's Manual.

(a) Engine Controls

Engine controls include a throttle, a mixture control and a carburetor heat control. The throttle, mixture, and carburetor heat controls are placed at the lower center of the instrument panel (See Fig. 7-2). The throttle controls engine power. The throttle is fully open in the full forward position and closed in the fully aft position. The throttle has a friction lock. Rotating the round knurled knob at the base of the throttle clockwise increases the friction, and counterclockwise decreases the friction.The fuel / air ratio is adjusted by the mixture control. The RICH position is full forward, and full aft is the IDLE CUT-OFF position. For small adjustments, the control may be moved forward by rotating the knob clockwise and aft by rotating the knob counterclockwise. For larger adjustments, the knob may be moved forward or aft by depressing the lock button in the end of control.

CAUTION !

Do not force the pressure on the Mixture control and do not turn the knurled knob when the mixture control is already fully forward (RICH) as this may cause damage to the mixture control mechanism.

The carburetor heat is activated by pulling aft on the “Carburetor Heat” control knob. This will supply the carburetor with unfiltered preheated air.

(b) The VM 1000 Engine Management System

NOTE! The VM 1000 engine management system and its operation is described subsequently with sufficient information for safe operation of the aircraft. For a more complete description and operation of the VM-1000 System refer to the VM 1000 Supplement at Section 9.

VM 1000 (Schematic)

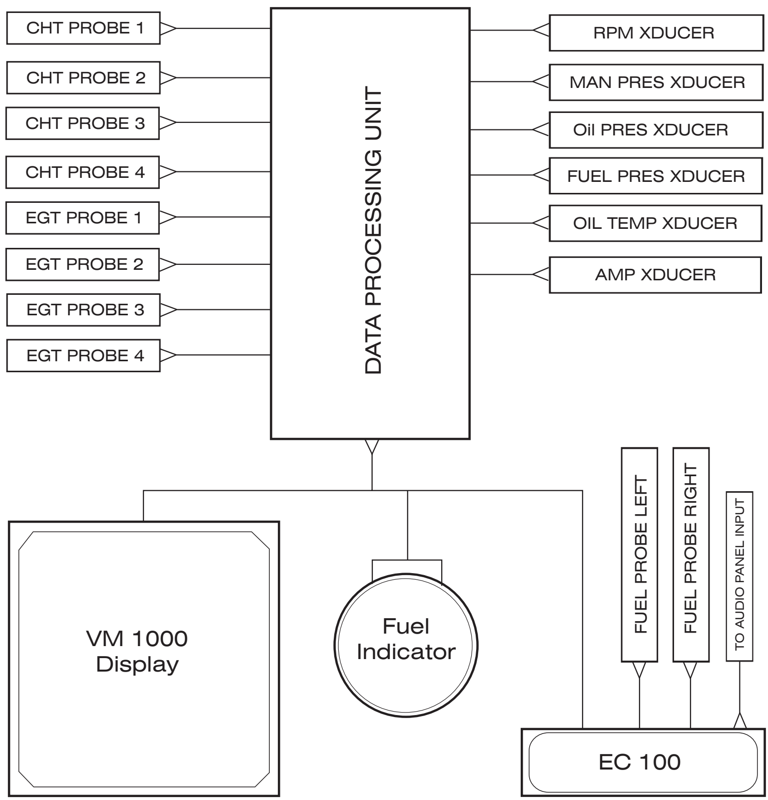


Figure 7-5
VM 1000 - Schematic

(1) Description

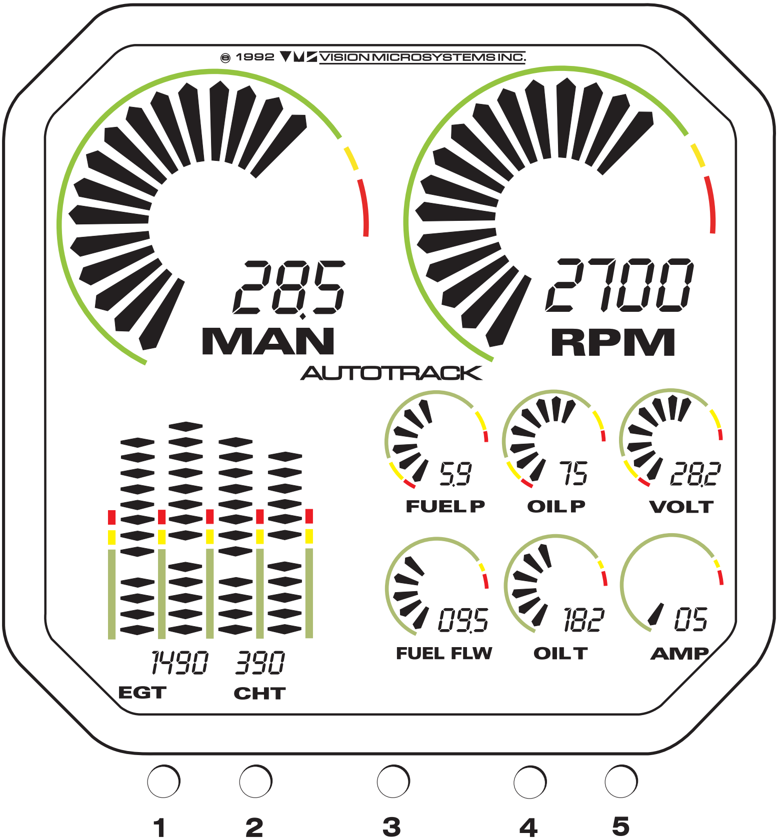
A data processing unit (DPU) receives electrical signals generated from different engine sensors. The DPU output is connected with the VM 1000 indicator (See Fig. 7-6), the EC 100 system (See Fig. 7-7), and when installed, with a digital clock and an OAT / CAT indicator.(See Fig. 7-5)

The VM 1000 Indicator
The VM 1000 Indicator is located on the right section of instrument panel adjacent to the radios.
Table 7-1 shows the displayed engine parameters, the units, the full sweep graphic display resolution, and the incremental steps of the digital readout.

Color markings of operating ranges, caution ranges, and prohibited ranges are described in Section 2 “Limitations”.

Parameter	Unit	Graphic Display Resolution	Digit. Display Incremental Steps
Man Pressure	in.HG	1” IN. HG	0.01 IN.HG
Engine Speed	RPM	Proportional	10 RPM
Fuel Pressure	PSI	Proportional	0.1 PSI
Oil Pressure	PSI	Proportional	1 PSI
Oil Temperature	°F	Proportional	1 °F
Voltage	V	Proportional	0.1 V
Amperage	A	Proportional	1 A
CHT	°F	N.A.	1 °F
EGT	°F	N.A.	1° F

Table 7-1
VM 1000 - Display parameters



Button 1:	Select EGT Graphic Modes
Button 2:	Select EGT & CHT Digital Modes
Button 3:	Select Autotrack ON / OFF
Button 4:	Select Fuel Computer Modes
Button 5:	Select Flight Data Recorder Info

Figure 7-6
VM 1000 Indicator

The Electronic Checklist and Caution Advisory System EC 100

WARNING !

The EC 100 checklist function may serve as a general guideline for the pilot while accomplishing normal procedures.
However, the pilot must be fully familiar with the normal and emergency procedures provided in Section 3 and Section 4 of this handbook.

The EC 100 display is incorporated in the upper left instrument panel. The system provides four several categories of easily accessed information:
- Engine information, such as power, number of cylinders, etc;
- Normal procedures checklists;
- Alerts and warnings.

The following lists the normal procedures checklists that may be selected:
- Before Starting Engine
- Starting Cold Engine
- Starting Hot Engine
- Taxiing
- Run Up
- Takeoff (Normal Conditions)
- Climb
- Cruise
- Descent
- Approach
- Landing
- Engine Shut Down

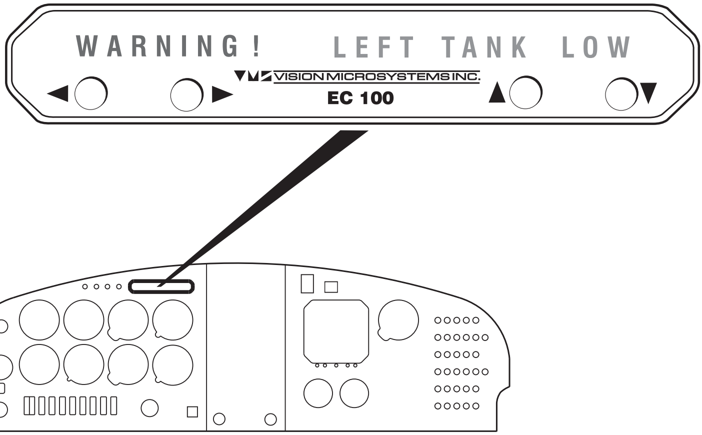


Figure 7-7
EC 100 Display

The checklist actions and/or checks will appear in the EC 100 display shortened.

When an alert/warning condition occurs, the EC 100 will automatically begin to flash the condition and a pulsing audio side tone will be momentarily present.

(2) Operation

The VM 1000 Indicator

To set the VM 1000 engine management system in operation, place the "BAT" switch in ON position. After power-up the system is ready for flight.
Five control buttons are located below the VM 1000 indicator. Refer to figure 7-6 for a quick reference.

To change graphic sweep display formats, simply hold BUTTON 3 in during power-up until the display begins showing actual parameters and is operating.
The diamond graph display in the lower left corner of the VM 1000 indicator has two display modes:

Normal Modes:

The diamond graph system displays CHT between the green, yellow and red range marks, left to right, one through four. EGT graphics are displayed above the CHT redline marks where they can be easily observed. A defective CHT or EGT probe will leave the respective graph blank. A flashing CHT graph indicates a cylinder is too hot or is being shock cooled.

The digital display below the diamond graph system shows in the default mode the number of the cylinder that leaned before any other during leaning mode (ex: "P1" means cylinder 1), and the hottest cylinder (ex: "H3" means cylinder 3). By pressing BUTTON 2 one can select other cylinders. Then the display will show temperatures for each EGT and CHT pair and periodically the cylinder number.

Leaning Mode:

Leaning mode is selected by pressing BUTTON 1 while in normal mode. The entire diamond graph display is temporarily used for precise high resolution leaning.
A flashing EGT graph indicates that the leanest EGT has been detected.
The display can be returned to the normal mode by BUTTON 1 again.

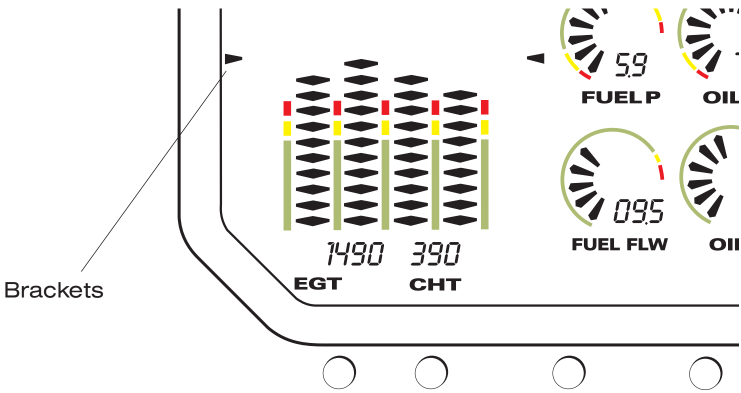


Figure 7-8
Leaning Mode

The Electronic Checklist and Caution Advisory System EC 100

With reference to Figure 7-8, to select the desired category, press the ► button to go forward or the ◄ button to go backwards. When the desired category appears, press the ▼ button to select it and again to see further information.

In the event of an alert or warning, pressing any button will cause

the EC 100 alarm will be removed for approx. 1,5 minutes, allowing to access other information.

In case of an emergency, press BOTH the ◄ and ► buttons. This will immediately select the emergency checklist category and disable any warning/alert messages. Use ► to page through the major checklist topics. Press ▼ button to select desired information.
To quickly return to the beginning display, press both the ▼ and ▲ buttons until the beginning display appears.

(c) New Engine Break-In Period

The Lycoming Engine Operation Manual should be consulted to obtain detailed information regarding the new engine break-in period. When the engine leaves the Lycoming factory, it is usable throughout the entire power spectrum. However, Pilots should not, if at all possible exceed cruise powers of 80% until a total of 50 hours has been accumulated and oil consumption has stabilized. Until this time aviation mineral oil (MIL-L-6082) should be used.

(d) Ignition and Starting System

Engine ignition is provided by two engine driven magnetos, and two spark plugs in each cylinder.
The right magneto fires the lower right and upper left spark plugs, and the left magneto fires the lower left and upper right spark plugs.
Both magnetos work simultaneously and, in such a way, guarantee a more complete combustion of the fuel/air mixture.
Ignition and starter operation is controlled by a combined, rotary type switch. This switch is located on the left side of the instrument panel. It has the positions OFF, R, L, BOTH and START. During normal engine operation, the switch must be placed on the BOTH position and only for magneto checks or for emergency use are the R or L

positions used. While starting the engine, the switch is to be rotated to the spring loaded START position. This will activate the starter when ALT / BAT switch in the ON position. When released, the starter engage switch will return automatically to the BOTH position. To provide an easier starting in cold weather conditions the aircraft is equipped with an engine priming system. The system consists off one primer pump and three priming nozzles on the cylinders No. 1, 2, and 4. The manually driven primer pump is installed on the middle console left to the fuel shut-off valve. The fuel priming nozzles inject the fuel direct in front of the cylinder intake valves.

(e) Air Induction System

Carburetor induction air enters through an air intake on the right side of the lower cowling and is carried through a wet air filter, an alternate air door and ducts to the carburetor air box.
Should the air induction filter become blocked or when the carburetor heat is in the ON position the engine will draw unfiltered preheated air from the area around the exhaust pipe inside the lower cowl.

CAUTION !

When the carburetor heat switched ON, the heated air is sucked in without filtering. Therefore, the carburetor heat should always be turned off on the ground.

(f) The Lubrication System

The engine has a fully pressurized wet sump lubrication system. Aviation grade oil serves as lubricant with the correct viscosity recommended by the engine manufacturer depending on the conditions for use. For engine oil grade and specifications, refer to Section 8 “HANDLING AND MAINTENANCE“.

The capacity of the engine sump is 7,6 Liters (8 U.S. quarts).
The oil passes through an oil suction strainer screen into the engine driven oil pump, and then to the engine parts to be lubricated.
A bypass valve on the oil pump allows cold oil passage and directs hot oil from the engine to the oil cooler. After the cooling oil return, it passes the full-flow oil filter again and into the engine.
The oil pressure is held constant by an oil pressure relief valve, which allows excessive oil to return to the sump.
After lubrication, the oil flows back into the sump again by gravity.
The oil filler cap/oil dipstick for oil level check is located at the right rear of the engine. It is accessible through a small access door on the top right side of the engine cowling.

CAUTION !

The engine should not be operated on less than 5 Liters (5,2 U.S. quarts) of oil.

(g) Cooling System

The engine cooling air enters through two intake openings located in front of the engine cowling on both sides of the propeller. The air is then directed by air baffles around the cylinders and other relevant areas of the engine. The air is discharged through an opening at the bottom rear edge of the cowling.

(h) Exhaust System

The exhaust system is constructed of stainless steel and incorporates a main exhaust with a heater shroud and a secondary exhaust. The heater shroud supplies heated air for the cabin and the defroster system.

7.27 PROPELLER

The aircraft is equipped with a fixed pitch, composite, two blade MT-Propeller. The propeller composite construction consists of multiples laminated and plastic covered ash wood strips with bonded stainless steel metal tips.
The Propeller has a diameter of 1,854 m (73 in.), and a pitch of 9 mm (0.35 in.) at 0,75 blade radius.

7.29 FUEL SYSTEM

The fuel system of the SA 160 (See Fig. 7-9) consists of two main fuel tanks which are installed in the wings, a feeder tank behind the seats, a fuel shut-off valve on the center pedestal, an auxiliary fuel pump, a gascolator, an engine driven fuel pump and a single-barrel float type carburetor in the engine compartment. Fuel lines are made of flexible hoses and aluminum depending upon location. The fuel system quantities are as follow:

Fuel Quantity Data:

Total Fuel:	123 l	(32.5 U.S. Gallons)
Usable Fuel:	114 l	(30.2 U.S. Gallons)
Unusable Fuel:	9 l	(2.3 U.S. Gallons)

(a) Fuel Distribution

In the SA 160, fuel flows from the tank to the engine by gravity. However, an electrically operated auxiliary fuel pump is provided to support fuel supply in case of the failure of the engine driven pump.

Fuel flows from the two wing tanks through flexible hoses and aluminum-fuel-lines to air bleeder tubes and to the feeder tank.
The feeder tank guarantees a continuous fuel supply to the engine during a possible short-term interruption of the fuel flow from the wing fuel tanks. This may occur during descend with high nose down attitude when the wing tank have little fuel remaining since the fuel is draw-off from the rear part of the wing fuel tanks. However the size of the feeder tank guarantees a secure fuel supply to the engine during longer descents.

FUEL SYSTEM SCHEMATIC

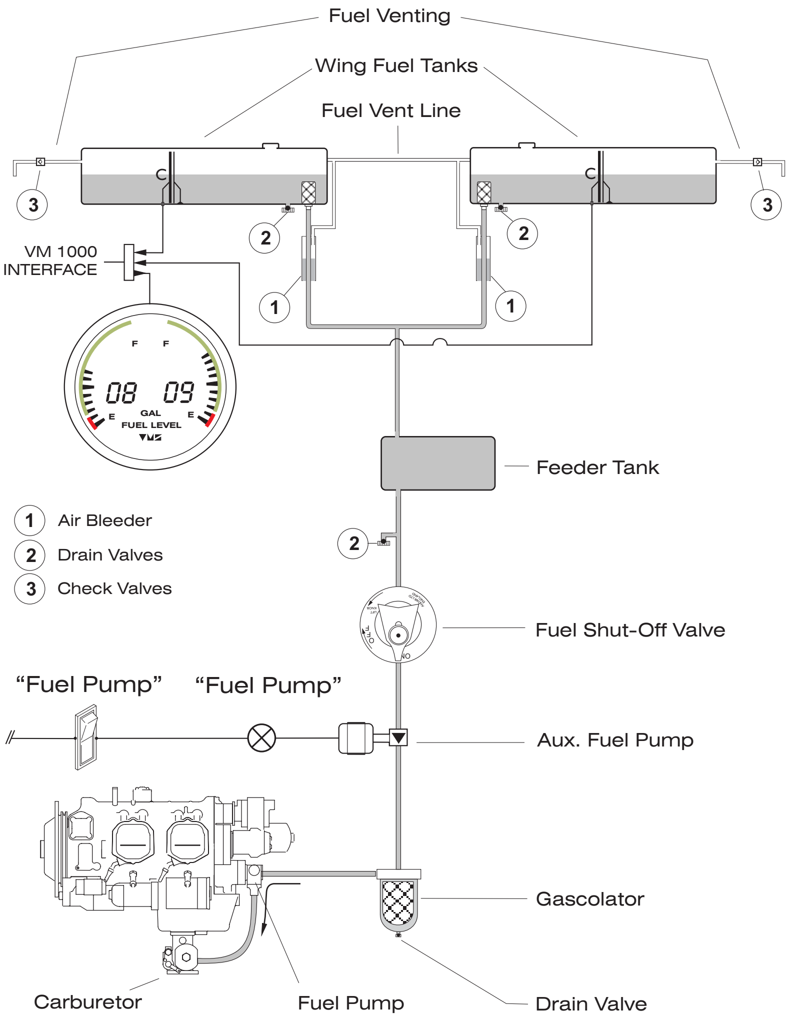


Figure 7-9
Fuel System Schematic

WARNING !

With less than 10 liters (2.5 Gallons) per each wing tank (red arc at indicator) power on descents with flaps extended must be limited to maximum 10 minutes duration.

After 10 minutes of descend in this regime, a three-minute level flight attitude with flaps retracted is to be accomplished.

From the feeder tank, the fuel flows to the fuel shut off valve to the auxiliary fuel pump (through fire a wall fitting) and to the gascolator. Past the gascolator, fuel flows through the fuel pump located on the engine rear accessory case, to the carburetor located at the bottom of the engine
(See Fig. 7-8).

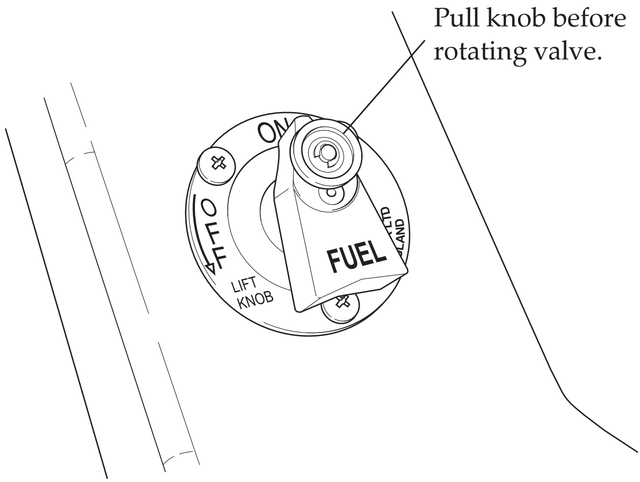


Figure 7-10
Fuel Shut-Off Valve

The fuel shut off valve (See Fig. 7-10) is located on the center pedestal below the instrument panel. The valve has two positions "OFF" or "ON". When in the "OFF" position, the valve shuts off the fuel supply to the engine during critical emergencies such as engine fire.
Before it can it can be rotated to the desired position, the valve must be unlocked by pulling the round knob on the center of the valve while initiating the rotation.

(b) Fuel Quantity Indication

Fuel quantity is measured by two capacitive type fuel level probes: one in each tank. Fuel quantity is indicated by a fuel quantity indicator located on the instrument panel below the VM 1000 display (Figure 7-11).
The indicator displays a left and a right digital read-out of gallons of fuel remaining in each tank. Additionally the left and right

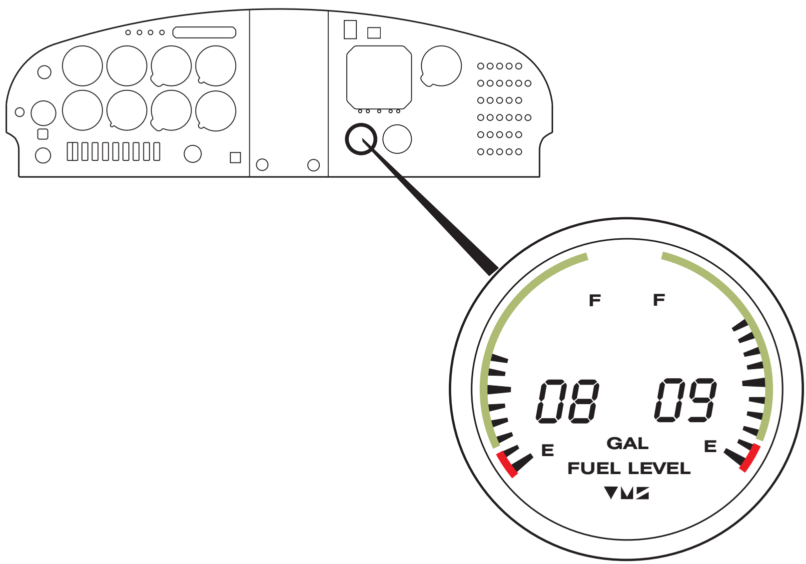


Figure 7-11
Fuel Level Indicator

displays are also presented graphically to show percentage of fuel remaining for quick reference. The indicator red arc shows a low fuel level, in the corresponding tank, from 0 - 2.5 gallons. When a fuel level of 2.5 gallons and less has been reached in a given tank, a “Lo” will be displayed in the corresponding display area of the fuel indicator and the EC 100 will begin to flash low fuel level warning signal coupled to a pulsing audio warning tone. Accurate fuel reading can only be taken in non-accelerated level flight.

(c) Fuel Venting

Adequate fuel tank venting is essential for a continuous fuel supply. Blockage of the system will result in decreased fuel flow and a potential engine stoppage.
Both fuel tanks are vented outboard through vent lines which protrude through the bottom surface of both wings near the wing strut. The tanks are interconnected by a vent line from the right fuel tank to the left tank. The header-tank vent line also connects to the left and right wing tank vent line.

CAUTION !

Clean and non-obstructed fuel vents are essential for an uninterrupted fuel supply.

(d) Fuel Drain System

The fuel system is equipped with drain valves to provide a means for removing trapped water and for the examination of fuel contamination. (See Fig. 7-12).
Each wing fuel tank has a drain-valve at its base. The wing tank drain valves are located on the underside of wing in the wing root area (See Fig. 7-13). A drain-valve is also located at the lowest point of the fuel system, which can be accessed at the bottom of the fuselage. In

addition, the gascolator, located on the lower left front of the firewall, has also a drain, which is accessible from the bottom of the cowling section.

The fuel should be checked daily before the first flight while performing the preflight checks and after each refueling to check for water or sediment contamination. Fuel contamination check can be done by using a sampler cup. Make sure that enough fuel has been drained to ensure that all water and sediment has been removed.

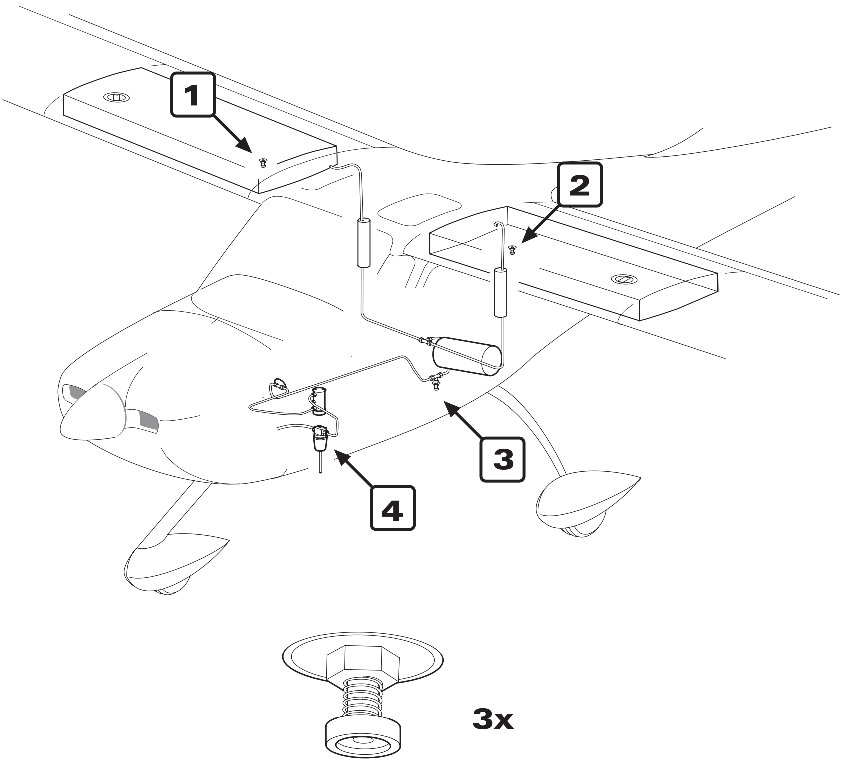


Figure 7-11
Drain Valves

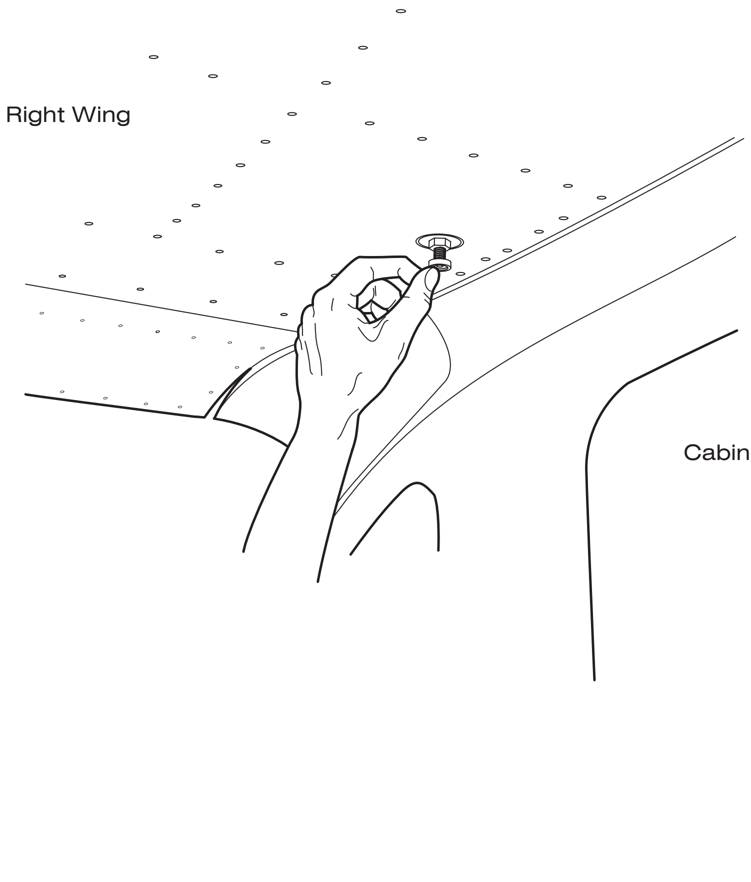


Figure 7-13
Drain Valves on the base of the wing fuel tanks.

7.31 BRAKE SYSTEM

The brake system of the SA 160 comprises of single disc, hydraulically actuated brakes on each main landing gear wheel, 4 master cylinders, located immediately behind the 4 rudder pedals, a brake fluid reservoir on the left cabin wall near the fire wall, and brake fluid lines and hoses.

The brakes are operated by pushing the upper part of either the left or right rudder pedal at each pilot position. Each set of rudder pedals is interconnected. The applied pressure is mechanically transmitted to the respective brake master cylinder to the respective hydraulic brake assembly via hydraulic lines.

Parking Brake

The SA 160 is equipped with a parking brake system. The parking brake system consists of a parking brake valve, the parking brake control knob on the middle console, right to the fuel shut-off valve, and brake lines.
The brake lines from the toe brakes to the main wheel brake calipers are plumped through the parking brake valve. With the parking brake control knob pushed in, the check valves are mechanically held open allowing normal brake operation. When the knob is pulled out, the parking brake valve holds the applied brake pressure, locking the brakes into their current position.

To set the parking brake, first apply brake pressure using the toe brakes and then pull the parking brake knob.

7.33 ELECTRICAL SYSTEM

The SA 160 is equipped with a 28-volt, DC electrical system.
It is powered by a belt driven alternator and a 24V battery, located in the aft fuselage behind the baggage compartment.
An external power source can be connected. The external power receptacle is located on the aft wall of the baggage compartment.
All electrical systems components are protected by circuit breakers. The circuit breaker panel is located on the extreme right side of the instrument panel.
The electric power distribution to the various accessories has been designed for functionality and safety (See Fig. 7-14).
The alternator output is connected to the main bus through a 50-amp circuit breaker. The battery bus is connected to the battery or the external power source. The main and battery bus are interconnected by a 50-amp circuit breaker. The avionic bus 1 is powered through the battery bus and the avionic bus 2 through the main bus.

(a) ALT/BAT Switch

The switch ALT / BAT, also named master switch, is a split rocker type switch. The master switch is located on the instrument panel on the extreme left of the row of switches. The master switch is colored red. Through the right half of the switch, labeled BAT, the battery and main bus bars are supplied with power. All electrical devices connected to the main bus can then be activated.
If an external power source is connected to the aircraft, the electrical power to the main bus is still done through the BAT switch.

The left section of the master switch, the alternator ALT switch controls the alternator. During start up the alternator is put into standby and when the engine is running the alternator powers all the electrical devices connected to the main and battery bus bars.
Normally, both sides of the ALT / BAT switch should be used

simultaneously. However, if a situation so demands, it is possible to switch to either battery ON or alternator OFF only.

(b) AVIONIC Switches

The AVIONIC 1 and AVIONIC 2 (IFR) switches are located on the left part of the instrument panel, right to the ALT / BAT switch.
They control the flow of current to the avionic bus 1 and the avionic bus 2 (IFR).
For IFR equipped aircraft the bus 1 and bus 2 switches provide the option to remove power supply from the avionic buses separately.
This provides the capability to disconnect nonessential electrical accessories in the event of an alternator failure.

CAUTION !

To avoid damage to the avionics equipment the AVIONIC power switches should be placed in the OFF position prior to turning the ALT / BAT switch ON or OFF, starting the engine, or applying an external power source.

(c) Indicating and Warning Devices

Ammeter

The ammeter is integrated in the VM 1000 Engine Management System. The amperage is displayed on the VM 1000 indicator in the lower right area both graphically and digitally (See Fig. 7-6).
The ammeter system functions as an “alternator load meter” displaying current flow from the alternator to aircraft electrical system.
Additionally the system has a built-in warning that is coupled with the EC 100. When the alternator does not produce enough power for the electrical system, the EC 100 will automatically begin to flash the warning “AMPS TO LOW” and a pulsing audio tone will be present.

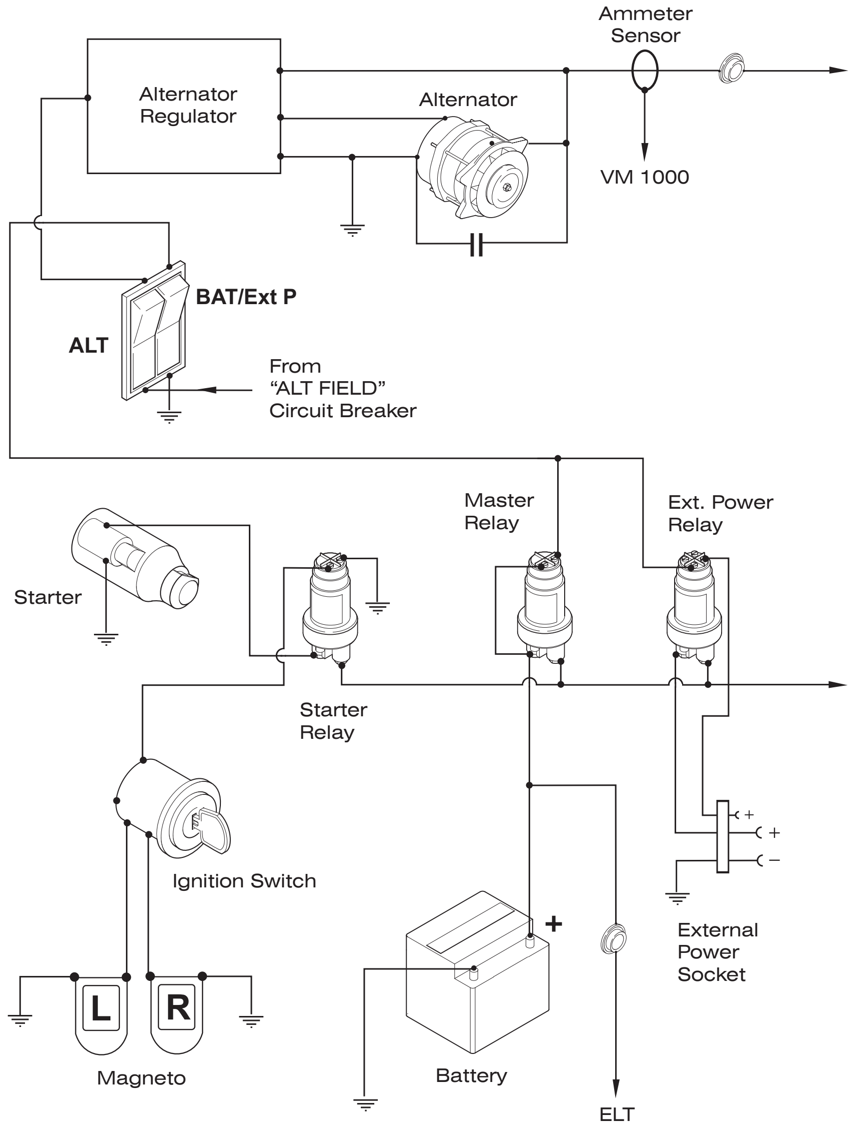


Figure 7-14 (1)
Electrical Power Distribution (Simplified)

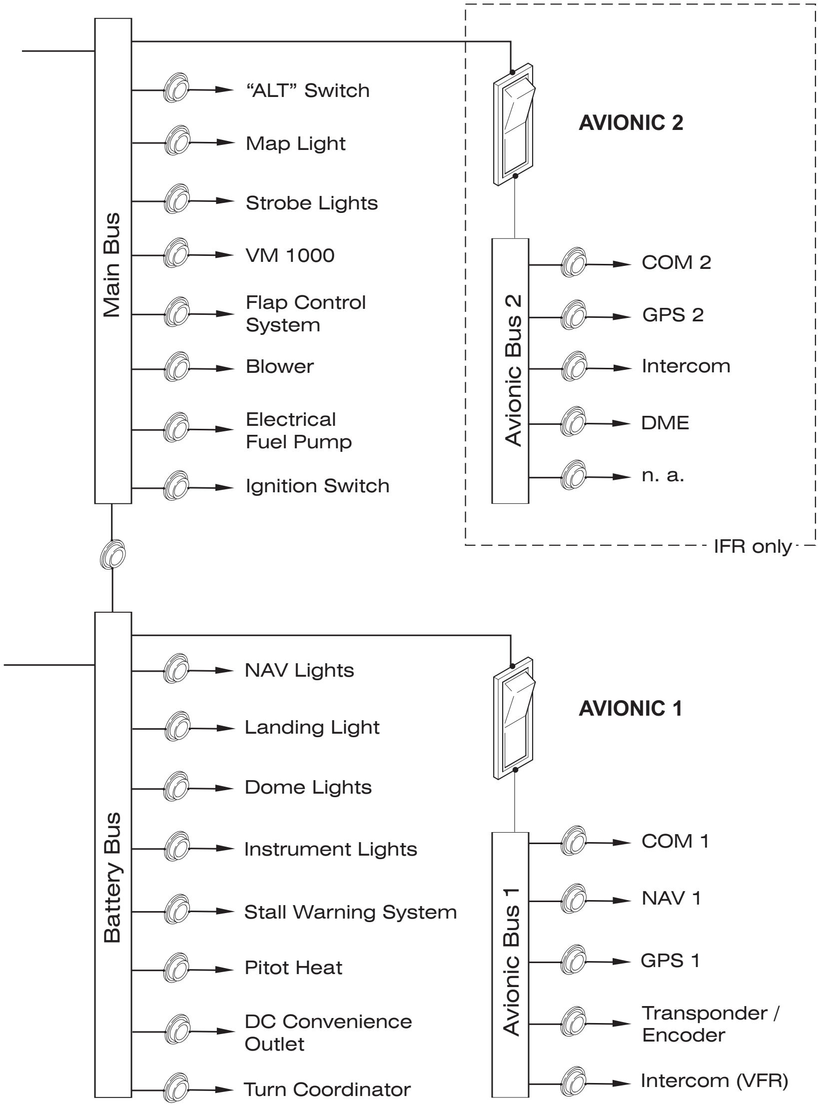


Figure 7-14 (2)
Electrical Power Distribution (Simplified)

This occurs at low amperage levels of approximately less than 2 amps.

Voltmeter

The voltmeter is integrated in the VM 1000 Engine Management System. The voltage supplied to the aircraft electrical system is displayed on the VM 1000 indicator in the lower right area both graphically and digitally (See Fig. 7-5).
If the BAT switch is ON (without further accessories) approximately 25 V will be indicated.
When the engine is operating and the electrical power supply system is functioning proprely, approximately 26 - 28 V should be indicated.
Additionally the system has a built-in warning that is coupled with the EC 100. When the system voltage is out of nominal range (26 - 28 V), either to low or to high, the EC 100 will automatically begin to flash the respective warning and a pulsing audio tone will be present.
indicated.
Additionally the system has a built-in warning that is coupled with the EC 100. When the system voltage is out of nominal range (26 - 28 V), either to low or to high, the EC 100 will automatically begin to flash the respective warning and a pulsing audio tone will be present.

Circuit Breakers

The circuit breaker panel is located on the extreme right side of the instrument panel (See Fig. 7-15).

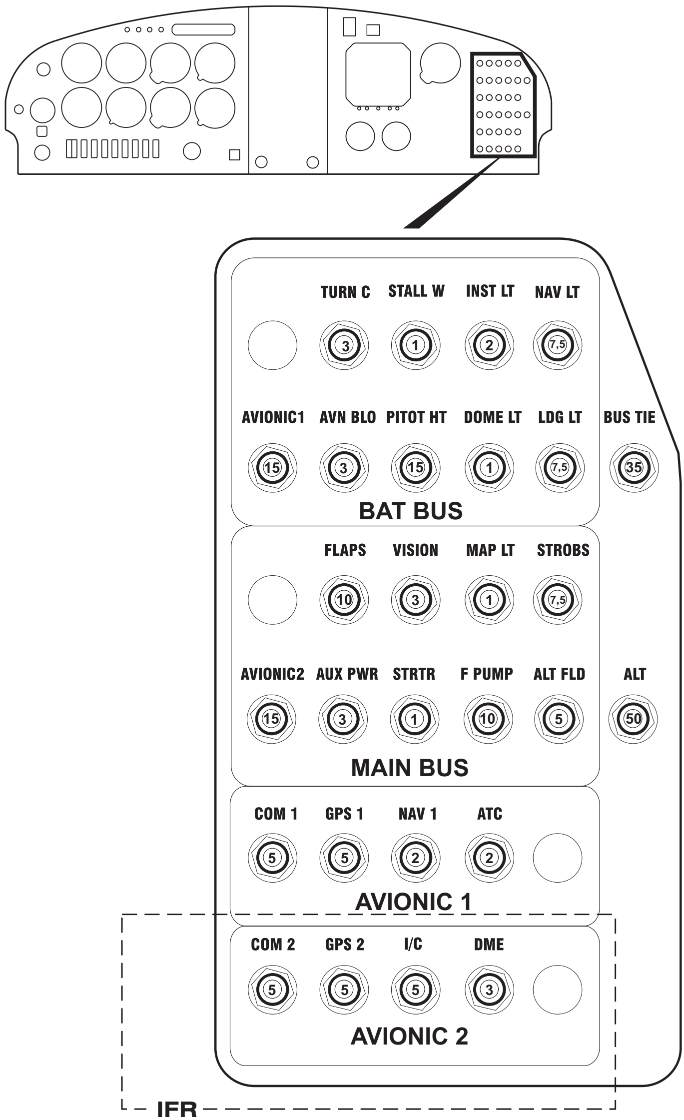


Figure 7-15
Circuit Breaker Panel

7.35 LIGHTS

(a) Interior Lighting

The interior lighting of the SA 160 consists of three independent lighting systems: dome light, instrument light, and map light.

Dome Light

Two single, ceiling mounted incandescent dome lights provides for general illumination of the cabin area during pre-flight preparation and after landing. Additionally they can be used as an emergency light in the event the instrument lights fail.
The dome lights are turned off and on with a rocker type switch located in the row of switches below the flight instruments, which is labeled "DOME LIGHT".

Instrument Light

The instrument light system subdivides into three portions:
internal lighted instruments, external lighted instruments, and the spotlight for various controls.
Most of the flight instruments and the avionics equipment are integrally lighted. All other instruments are lighted with standard postlights.
Four LED spotlights: three mounted in the headliner above the seats and one above the heat controls, provide additional light for specific instrument panel section and middle console areas.
The instrument light system is controlled and dimmed through the instrument light dimmer switch (labeled "INST LT") located right side the row of switches below the flight instruments.

Map Light

Two luminescent stripes installed under the glareshield provide

overall lighting for the instrument panel. In the event of an instrument light failure, the map light is sufficient to light all the instruments and controls required for safe flight and landing by night.
The map light system is controlled and dimmed through the instrument light dimmer switch (labeled "MAP LIGHT") located right side the row of switches below the flight instruments.

Day/Night Function for Advisory Lights

When the instrument light system is turned on the brightness of the "Fuel Pump", "Pitot HEAT" and "Flaps in Motion" annunciator lights will be simultaneously reduced.

CAUTION !

In order to obtain the proper light intensity from the warning lights the instrument light dimmer switch must be in the off position for flight during the day.

(b) Exterior Lighting

The aircraft has a combined navigation / strobe lights on each wing tip as well as a landing light installed on the left side of the lower engine cowling.

The exterior light control switches are located on the lower section of the left instrument panel in front of the first pilot.
To activate the navigation lights, strobe light and landing light, the respective switches must be placed in the "ON" position.

7.37 VENTILATION AND HEATING

To supply fresh air into the cabin, two adjustable air nozzles are provided. They are located on the forward left and right cabin sidewall areas just below the instrument panel.
Ram air is provided to the air nozzles using air intake located on each side of the fuselage. The amount of fresh air can be adjusted by pivot tabs inside the nozzles.

The heating system is used to supply heated air to the cabin and to the windshield.
Ram air flows through a shroud attached to the exhaust and a duct to the heat valve. The heat valve is located on the firewall in the engine compartment. Using this valve, the amount of heated air can be regulated. The valve is actuated by a control “CABIN HEAT“, located on the center pedestal below the instrument panel, via a ‚Bowden cable.
If the “CABIN HEAT” knob in the full forward position the heat relief valve is closed and heated air cannot enters the cabin. If the knob is pulled out, the heat relief valve opens. Additional heat is available by pulling the knob out further. Maximum heat is available with the cabin heat knob in the most rear position.

Via the heat valve the hot air travels through to the heated air distributor box. This box is located in the cabin at the firewall. By the heated air distributor, the amount of heated air which should reach to the area of the pilot's and co-pilot's feet and to the windshield can be adjusted. A door inside the heated air distributor is operated by the control “WINDSHIELD / CABIN” via a Bowden cable. The control knob is located just below the “CABIN HEAT” control on the center pedestal. For maximum effect, the fresh air nozzles should be closed.

7.39 STATIC AND PITOT PRESSURE SYSTEM

The static and pitot pressure system supplies pitot and static pressure for the airspeed indicator, the altimeter and the vertical speed indicator (See fig. 7-16).

The aircraft dynamic pressure is picked up by the pitot tube, installed on the underside of the left wing, and carried through a line inside the wing strut and fuselage to the relevant instruments on the panel.

The static pressure source is performed by two static-ports on the left and right side of the fuselage before the empennage. The static pressure reaches the instrument panel via a static pressure line in the fuselage.

The pitot tube head is equipped with a heating element to prevent icing during the flight in potential icing conditions.
Pitot tube heating is activated switching the PITOT HT switch on the ON position.
Illumination of an amber “PITOT HT OFF” caution light (IFR), located on the upper instrument panel left to the EC 100 indicates that the pitot heater is not operational.

Both the pitot and the static pressure lines can be drained through separate drain valves, located on the bottom of the fuselage.

A cover should be placed over the pitot tube while the aircraft is parked outside, to prevent insects and water from entering the pitot orifice. A partially or completely blocked pitot vent will result erroneous, erratic, or zero readings on the associated instruments.

CAUTION !

Make sure that the pitot cover is removed before flight.

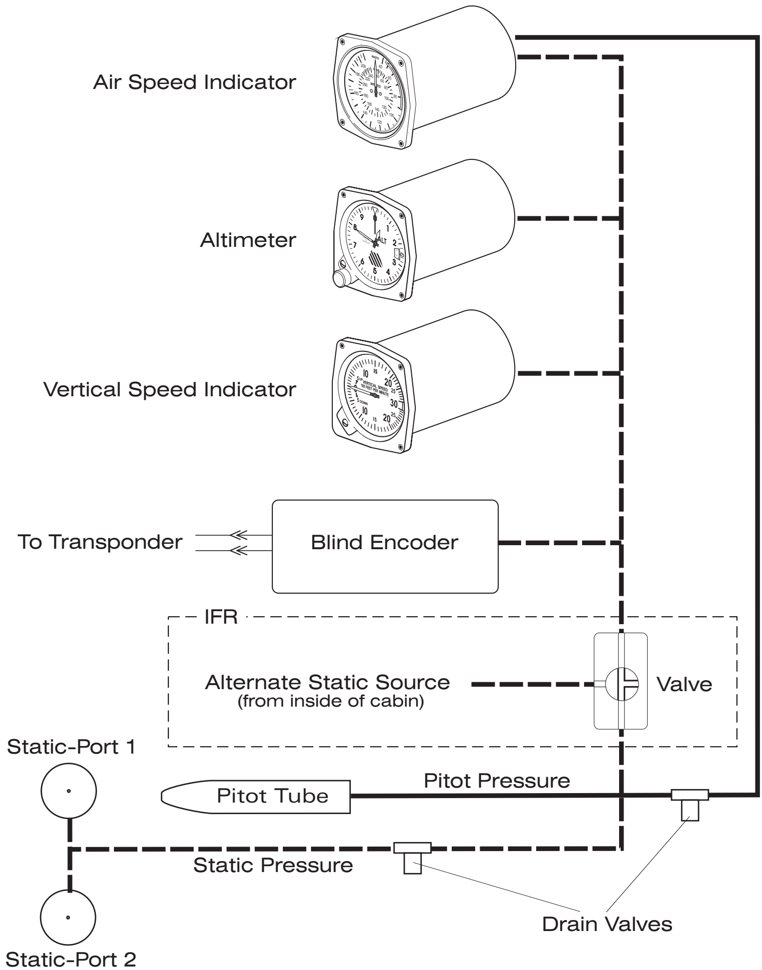


Figure 7-16
Static and Pitot Pressure System Schematic

Alternate Static Source (IFR)

An alternate static pressure source valve is installed on the left instrument panel. This valve supplies static pressure from inside the cabin instead of the external static ports.
If a blockage in the standard static system is suspected due water or ice, the alternate static source valve should be turned on.
Whenever the alternate static pressure source is selected, refer to airspeed calibration table (Alternate Static Source) in Section 5 for the corrections to be applied.

7.41 VACUUM SYSTEM

The vacuum system is provided to operate the air driven directional and attitude gyro instruments. The systems consists of an engine driven vacuum pump, a vacuum relief valve, filters, a vacuum suction gauge, and the necessary connecting tubing (See Fig. 7-17).

The dry-type air vacuum pump is flanged on the upper rear engine accessory case. A shear drive protects the pump from damage. If the vacuum pump fails or the drive shears, the air driven directional and attitude gyros will become inoperative.

A vacuum gauge, placed on the upper left instrument panel, provides the pilot with the system vacuum pressure during operation. A prolonged pressure decrease in the system over an extended period may indicate a dirty filter, dirty screens, a sticky vacuum regulator, or a leakage in the system. Zero pressure would indicate a sheared pump drive, a failed pump, a defective gauge, or a collapsed line. In the event of any gauge variation from the normal, the system should be checked by an authorized mechanic to prevent possible damage to system components

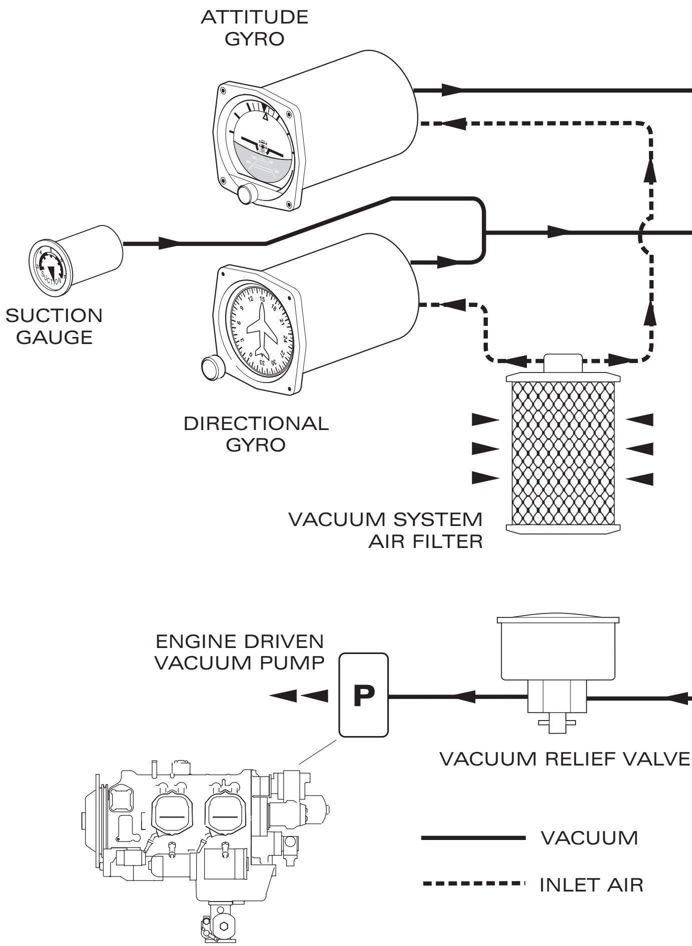


Figure 7-17
Vacuum System

or eventual system failure.
To protect the gyroscopes, the system has a vacuum relief valve that is attached to the firewall in the cabin that is adjusted so that the vacuum gauge will normally indicate 4.5 - 5.5 in. Hg.. This is sufficient to operate all gyroscopes within their rated RPM. A higher setting will damage the gyroscopes; at a lower setting, the gyroscopes could provide unreliable information. At high altitudes (above 12.000 ft), and at low engine RPM (for example during an approach), the vacuum gauge indicates lower vacuum pressure. This is normal and should not be construed as a system malfunction or an improperly adjusted vacuum relief valve.

7.43 STALL WARNING SYSTEM

The aircraft is equipped with a stall warning system. The signal provides the pilot with an audible alarm to warn him that a stall situation is developing.

The stall warning system consists of a mechanical transmitter, located in the leading edge of the left wing and a warning buzzer behind the instrument panel. Both are connected by electrical wires.
As the aircraft approaches a stall, the center of pressure on the upper surface of the wings moves much forward towards the leading edge of the wings. As a result, a micro plate located at the transmitter is deflected upwards. A mechanical contact is made thereby sending an electrical signal to the warning buzzer in the cockpit. The warning buzzer gives off an alerting tone.

7.45 AVIONICS

The following provides a description of the avionics package for the basic VFR version of the SA 160. For the SA 160 IFR version the owners should refer to the applicable supplements provided in section 9.

(a) Radio and Intercom

The standard equipment of the SA 160 includes a Bendix/King KX 125 VHF NAV/COM receiver-transmitter and an intercom system. The NAV/COM receiver-transmitter is mounted in the center of the instrument panel over the transponder. The intercom control panel is installed over the NAV/COM radio.

The NAV/COM is for radio communication with ground control or other aircraft. In addition, data of ground stations can be received and indicated for navigation purposes.

The connection of the crew headsets to the NAV/COM radio is provided and controlled by the intercom system. It facilitates external and internal communication of the crew members.

Fig. 7-XX shows the front view of the VHF NAV/COM receiver-transmitter and the control panel of the intercom system. The power supply of the NAV/COM radio is accomplished via a voltage converter set at 14 Volts. The current is connected through the "AVIONICS" switch. The radio and the intercom system are protected by the circuit breakers labeled NAV/COM and ICS.

(b) Transponder

The Transponder answers interrogating signals from ground stations and enables the ground station to determine the location and altitude of the aircraft.

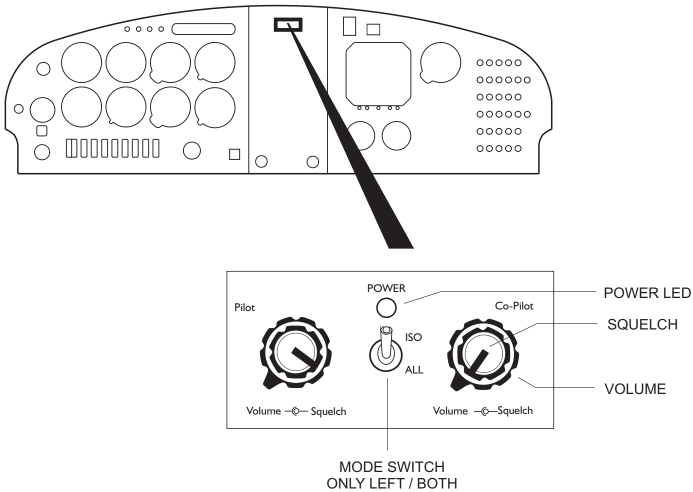
A Bendix/King KT 76C is incorporated into the SA 160.

The set consists of the antenna, which is mounted at the bottom of the fuselage, the encoder, located behind the instrument panel, and the receiver-transmitter unit, which is mounted in the instrument panel just below the NAV/COM radio.

The circuit breaker for the transponder is labeled "ATC".

Fig. 7-XX shows the Transponder front view.

For operating instructions and further information about the VHF NAV/COM radio and the transponder, please refer to the appropriate Bendix/King publications.



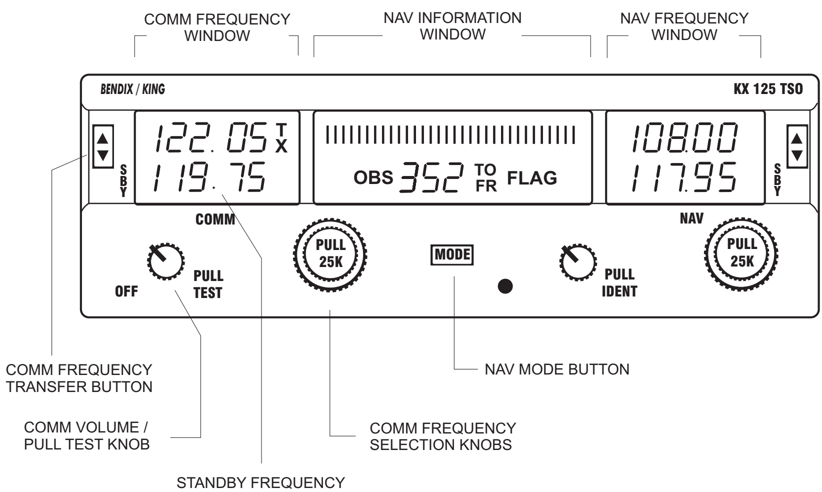


Figure 7-18
INTERCOM Control Panel and NAV / COM Receiver-Transmitter

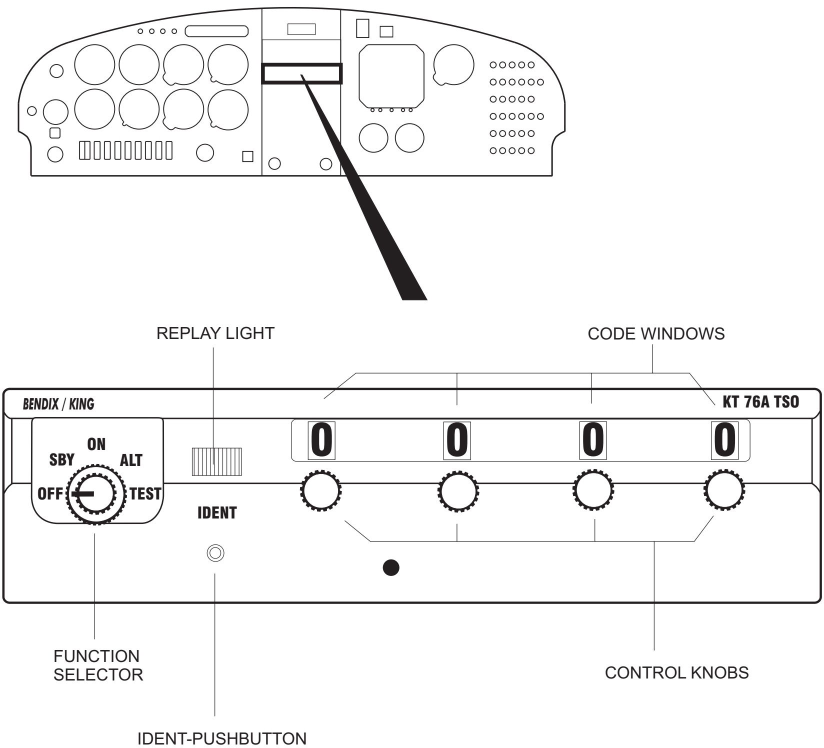


Figure 7-19
Transponder Front View

7.47 EMERGENCY LOCATOR TRANSMITTER (ELT)

The SA 160 comes equipped with an Artex ELT-200 emergency locator transmitter. The ELT activates automatically during a crash or manually by a remote switch. The ELT transmits the standard swept tone on international distress frequencies of 121,5 MHz and 243,0 MHz.

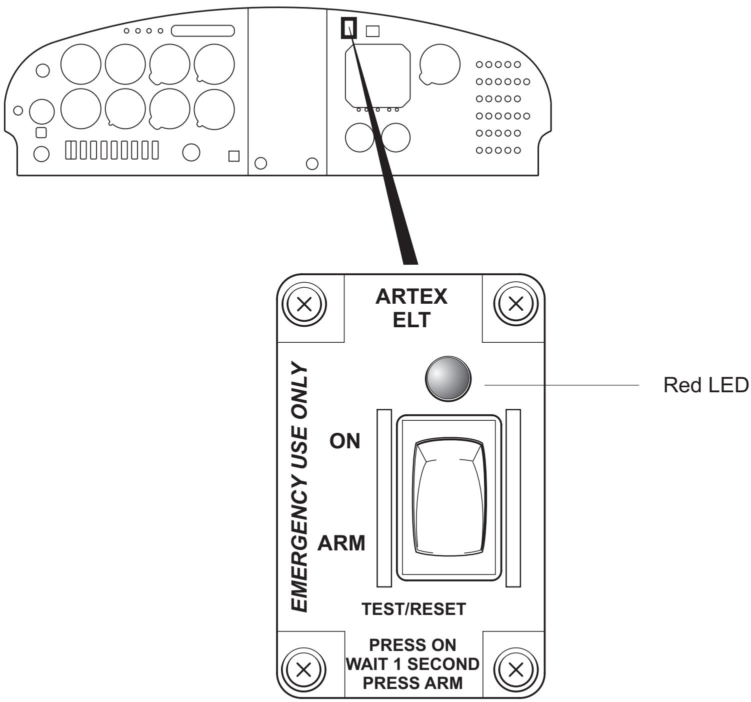


Figure 7-20
ELT Remote Switch /Annunciator

The ELT unit itself is located in the fuselage behind the cabin just over the battery. It is accessible through the baggage door.
The ELT can be manually operated by the flight crew using the remote switch/ annunciator installed on the upper right instrument panel (See Fig. 7-20). The red LED over the rocker switch illuminates when the ELT is transmitting.
The emergency transmitter works independently from the power supply of the aircraft since it has its own battery.
For complete operating instructions, refer the Artex ELT-200 Installation and Operation Manual published by the Artex Aircraft Supplies, Inc.

SECTION 8

GROUND HANDLING, SERVICING AND MAINTENANCE

TABLE OF CONTENTS

8.1 GENERAL

This section provides recommended procedures for proper ground handling, servicing, and maintenance of the SA 160.

The operator of an aircraft is responsible for ensuring that all airworthiness directives are complied with and that the handling, servicing and maintenance of the aircraft is done when required and in accordance with the appropriate Aviation Regulations. The following information will help you to keep your aircraft in the best mechanical and airworthy condition.

The SA 160 owner should stay in close contact with an authorized Symphony Aircraft Industries Inc. Service Station or with the Customer Service Department of SAI in order to keep abreast of the newest information on the management of this aircraft.

Any correspondence regarding your aircraft should include the aircraft serial number to ensure proper response. The Serial Number can be found on the Identification Plate, located on the lower part of the left forward doorpost.

The SA 160 Maintenance Manual, Illustrated Parts Catalog, and their revisions are available from Symphony Aircraft Industries Inc. Customer Service Department.

8.3 INSPECTION PERIODS

Symphony Aircraft Industries Inc. has developed an Inspection Time Interval Chart for the SA 160. This chart, provided by SAI, recommends inspection items and time intervals (e.g. 50, 100, 200 hours). Inspections requirements are provided in the SA 160 Maintenance Manual Chapter 5.

As required by the airworthiness regulations, all civil aircraft must undergo a complete inspection each twelve calendar months (annual), and in addition to this inspection, aircraft operated commercially (for hire) must have a complete inspection every 100 hours of operation in order to keep the Certificate of Airworthiness in effect. Applicable inspection items for 100 hrs or annual inspection are specified by the airworthiness authority of the respective SA 160 owners.
The SA 160 Inspection Time Intervals Chart should be used as specific augmentation, but it is not intended to be utilized as the primary checklist for inspection of the aircraft.

The required inspections should be accomplished by a properly trained and qualified mechanic of an authorized SAI Service Station. SAI will not accept responsibility for the continued airworthiness of an aircraft not maintained to these standards, and/or not brought into compliance with applicable Service Bulletins issued by SAI instructions issued by the engine, propeller, or accessory manufacturers, or Airworthiness Directives issued by the national Airworthiness Authority

8.5 PREVENTIVE MAINTENANCE

A certified pilot who owns or operates an aircraft not used as an air carrier may be authorized by its local airworthiness authority to perform limited preventive maintenance. Please refer to the specific local airworthiness authority to determine specific maintenance procedures, which are allowed.

All other maintenance operations necessary for the aircraft must be accomplished by authorized and licensed personnel only.

Prior to performing any preventive maintenance, SA 160 Maintenance Manual must be obtained to ensure that proper procedures are followed. Please, contact your SAI authorized Service Station or the SAI Customer Service Department to obtain a copy of the manual.
When maintenance is carried out, an entry must be made in the appropriate aircraft maintenance records.

8.7 ALTERATIONS TO THE AIRCRAFT

Prior to any alterations to the aircraft, please ensure that airworthiness of the aircraft is not violated.

WARNING !

Alterations or repairs to aircraft must only be carried out by licensed personnel.

8.9 GROUND HANDLING

(a) Towing

The aircraft may be moved by hand with a tow bar, or by a towing vehicle.

Towing by Tow Bar

One person can move the aircraft on a smooth, level surface by using a tow bar attached to the nose wheel. Helpers can push on the wing struts near their attachments to the fuselage or on the leading edge of the vertical fin.

CAUTION !

Do not exert force on the control surfaces, the propeller blades, or on the propeller spinner.

Towing with a Vehicle

To tow the aircraft with a vehicle, you should follow these steps:

(1) Attach the tow bar to the nose wheel and secure.
(2) Attach the tow bar to the vehicle.
(3) Remove any installed rudder lock.
(4) Remove wheel chocks.
(5) Tow aircraft to the desired location.

CAUTION !

While towing the aircraft with a vehicle a person should be in the cockpit, in order to be able to apply the brakes in the event of an emergency. In confined spaces two other helpers should ensure that the wings are clear of any obstacles while the aircraft is being towed.
Do not exceed the nose gear turning angle of 90° either side of center, or damage to the nose gear or main gear may occur.
Make sure that the tow bar is proper connected to the vehicle.

(6) Chock the main wheels fore/aft.
(7) Remove the tow bar from the vehicle and the aircraft.

(b) Parking

Park the aircraft as follows:

(1) If possible park the aircraft with the nose into the wind.
(2) Ensure that the flaps retracted.
(3) Check that all electrical devices are turned OFF and that the ALT /BAT switch is in OFF position.
(4) Set the parking brake.

CAUTION !

During cold weather accumulated moisture may freeze the brakes.

(5) Close cabin and baggage doors.

(c) Tiedown

A correct tiedown protects the parked aircraft against damage by gusty or strong winds.
The aircraft is to be parked as described in (b). In addition:

(1) Immobilize the ailerons and elevator by looping the seat belt around the control stick and pulling it tight.
(2) Chock the main gear wheels fore and aft.
(3) Secure tie-down ropes to the wing tie-down rings and to the tail ring. The wing tie-down rings are located on each upper end of the wing struts. Secure at approximately 45-degree angles to the ground and secure each rope to a ramp tie-down point.
(4) Install a pitot-tube cover.

(d) Jacking

If the aircraft requires jacking for maintenance, it may be jacked completely or partially off the ground, refer to the SA 160 Maintenance Manual. In Chapter 7 the specific procedures and required equipment are provided.

(e) Leveling

(1) For longitudinal leveling of the aircraft, the markings of the waterline may be used. These are located at the left side of the fuselage before the empennage (see Fig. 6-2, Section 6).
To this points a suitable level should be placed. Deflate the nose tire and/or raise the nose strut to properly center the bubble in the level.
(2) To level the aircraft laterally the cage tube, located in the upper cabin area (with wing attaching points) may be used.
Deflate the main gear wheels tires differentially .

8.11 SERVICING

(a) Oil

Oil Specification

Oil must be conform to the last revision of the Textron Lycoming Service Instruction No. 1014.
MIL-L-6082 Aviation Grade Straight Mineral Oil and MIL-L-22851 Aviation Grade Ashless Dispersant Oil should be used.

Oil Viscosity

Recommended viscosity of oils for air temperature range:

Mean Environment-Temperature	MIL-L-6082 Mineral	MIL-L-22851 Ashless Dispersant
Above 16°C	SAE 50	SAE 40 or SAE 50
-1°C (30 °F) to 32°C	SAE 40	SAE 40
-18°C (0 °F) to 21°C	SAE 30	SAE 30 or SAE 40
Below -12°C	SAE 20	SAE 30

Capacity

The engine has a oil capacity of 7.6 Litres (8 quarts), but it must not be operated on less than 5 Litres (5.2 quarts).

Oil and Oil Filter Change

(1) The SA 160 is delivered with straight mineral engine oil (MIL-L-6082). If the oil level is topped up within the first 25 hours of

operation, engine oil of the same specification and of the same recommended viscosity must be used (MIL-L-6082).
After 25 hours of operation, an oil and oil filter change is required. Refill the sump again with straight mineral oil and use until a total of 50 hours has accumulated or oil consumption has stabilized. After this, an oil and filter change is to be carried out and ashless dispersant oil (MIL-L 22851) should be now be used.

(2) For oil and oil filter change time intervals, refer to Lycoming Operator's Manual and appropriate Lycoming Service Instruction (Lubricating Oil Recommendations), latest issue.

Complete procedures for oil and filter change are described in the SA 160 Maintenance Manual, Chapter 12.

(b) Fuel

Approved Fuel Grades

100 LL Grade Aviation Fuel Color: Blue

CAUTION !

Approved grades aviation fuel only must be used for the SA 160

Capacity

Total Fuel:	123 l	(32.2 U.S. Gallons)
Usable Fuel:	114 l	(29.1 U.S. Gallons)
Unusable Fuel:	9 l	(3.1 U.S. Gallons)

For a fast and complete refueling of the tanks follow these steps:

(1) Move aircraft in a designated fuel loading area.

(2) Make sure that the BAT switch is in OFF position.
(3)Ensure fire fighting equipment is positioned and immediately available.
(4) Ground the aircraft and filling device as required.
(5) Place a suitable ladder to achieve easily the fuel filler caps on the top of wings.
(6) Fuel aircraft. Ensure approved grade of aviation fuel is used.
  (a) Remove the fuel cap and fill left tank to the desired level. Install fuel cap.
  (b) Remove the fuel cap and fill right tank to the desired level. Install fuel cap.
(7) Check correct lock of both fuel filler caps. Remove excess fuel from wing area using a cloth.
(8) Remove ground cables.
(9) Compare reading of fueled amount on filling device with reading on the fuel indicator in the aircraft.

Additives

The operation of the aircraft with an anti-freezing additive is approved. When anti-freezing additive is used, it must meet the specification MIL-I-27686. It should be blended uniformly with fuel while refueling and should not exceed 0.15% by volume of refueled quantity, and for effectiveness it should be blended at no less than 0.10% by volume. For example 42,6 ccm (1,5 fl.oz.) anti-freezing additive per 38 Liters (10 U.S. Gallons) fuel would fall in this range. Use only blending equipment that is recommended by the manufacturer to obtain proper fuel mixing ratio. In addition to the information in this section, the manufacturer's blending instructions should be used.

CAUTION !

Direct the anti-freezing additive into the flowing fuel stream. Start the additive feed after the start of refueling and stop before completion of refueling. Assure that the concentrated additive never comes into contact with any aircraft painted surfaces.

Fuel additive cannot be used as a substitute for preflight draining of the fuel system drains (see section 4 NORMAL PROCEDURES, "Preflight Check").

NOTE! Some fuels have anti-freezing additives included at the refinery, so no further blending is required.
The supplier and/or the specialists of the service station can offer information on the fuel composition.

8.13 CLEANING AND CARE

(a) Windshield and Windows

For cleaning the windshield and the windows use the following procedure:

(1) Park the aircraft in a hangar or in the shade, avoid places with a lot of dust caused by wind or vehicles.
(2) To prevent scratches, wash the windows carefully with plenty of a mild soap-and-water solution, using the palm of the hand to feel and dislodge dirt and mud.
A soft cloth, chamois leather or sponge should be used.
(3) Rinse thoroughly and then dry with a clean chamois.
(4) Wax the surface with a good commercial wax in accordance with manufacturer's instructions.

(5) Remove oil and grease with a cloth moistened with isopropy alcohol.

CAUTION !

Never use gasoline, benzene, alcohol, acetone, carbon tetrachloride, lacquer thinner or glass cleaner. These materials will soften the plastic and may cause it to crack.
Do not use cleaners with such chemical supplements whose effect is unknown on the windows surface.

(b) Exterior Surfaces

For cleaning the exterior surfaces use the following procedure:

(1) Park the aircraft in a hangar or in the shade, avoid places with a lot of dust caused by wind or vehicles.
(2) Close doors, if open, close access/inspection plates.

CAUTION !

Keep water away from pitot and static ports, electrical and avionics equipment.
Do not use harsh abrasives, alkaline soaps or detergents.

(3) Flush away loose dirt with water.
(4) Using a soft cleaning cloth or a sponge, wash with a mild, non-alkaline soap and water solution.
(5) Rinse thoroughly with clean water and then dry with a soft cloth or chamois.
(6) Apply regularly a high-quality automotive wax for aircraft care in accordance with manufacturer's instructions . This will

prevent painted surfaces from oxidizing and will help prevent unpainted surfaces from corroding. A heavier coating of wax on the leading surfaces will reduce abrasion problems in these areas.

(c) Propeller

As a part of every preflight inspection, take a look at the complete propeller observing the leading edge for cracks and the trailing edge for possible splitting by stone damage. Check for existing and proper PU-strip.
Clean propeller - if necessary - with any car wash solution or equivalent, or at least every 50 hours.
Remove grease and dirt with a commercial detergent which is suitable for polyurethane-lacquers.
Small scratches and nicks should be protected during routine maintenance with a coating of water resistant lacquer, preferably Polyurethane.
Further instructions for propeller operation, servicing and maintenance are contained in the propeller owner's manual furnished with the propeller.

(d) Engine

Periodic cleaning of engine and engine compartment can be very effective in preventive Maintenance.

Cleaning Procedures

WARNING !

Do not smoke or expose a flame within 100 feet of the cleaning area.

(1) Remove Cowling.

WARNING !

Do not use gasoline or other highly flammable substances.
Do not attempt to wash an engine when it is still hot or running.

CAUTION !

Do not direct cleaning solvents or water streams at openings on the alternator, vacuum pump, starter or magnetos.

(2) Carefully cover the openings on the alternator, the vacuum pump, the starter, and on the magnetos
(3) If engine is contaminated with salt or corrosive chemicals, first flush engine compartment with water.
(4) Apply a suitable solvent or cleaning agent to the engine compartment in accordance with manufacturer's instructions.
(5) Allow the solvent to remain on the engine from five to ten minutes.

CAUTION !

Cleaning agents should never be left in engine compartment Remains of cleaner or solvent may cause damage to components such as neoprene seals and silicone fire sleeves.

(6) Thoroughly rinse with clean warm water.
(7) Allow engine to dry or dry it completely using compressed air.
(8) Remove all coverings positioned to protection while cleaning.
(9) Lubricate all control arms and moving parts as required.
(10) Reinstall cowling.

WARNING !

Do not operate the engine until excess solvent has evaporated or otherwise been removed.

WARNING !

Before rotating the propeller by hand, ensure ignition switch is OFF, mixture control is in the IDLE CUT-OFF position, and the throttle is closed.

(11) Before starting engine, rotate the propeller by hand in the direction of normal rotation, no less than five complete revolutions.

e) Interior

To remove dust and loose dirt from seats and carpet, clean the interior regularly with a vacuum cleaner.
Interior panels such as sidewalls, door panels etc. may be cleaned using a mild detergent solution. Stubborn deposits may be removed using a suitable material cleaner in accordance with manufacturer's instructions. If in doubt, apply a small amount of cleaner to a small unobtrusive part and test it for reaction.
The instrument panel and center pedestal can be wiped with a slightly moistened cloth.

CAUTION !

Ensure the ALT/BAT switch is in the OFF position.

For cleaning and care of the seat upholstery use foam type detergent, such as is commercially available for car seats. Follow the manufacturer's instructions. Oil spots may be removed with household spot removers. Read the manufacturer's instructions on the container test it to an inconspicuous place and use it sparingly.
If the carpet is soiled, use a commercially available carpet cleaning product.

8.14 DURING FLYABLE STORAGE

The following guidelines are applicable for situations in which the aircraft is not used for periods of time between 7 and 30 Days. They are meant to help prevent deterioration of the aircraft during periods of non-use.

NOTE! If the aircraft is to be stored for longer periods, consult your Lycoming Operator's Manual for engine preservation recommendations, and the SA 160 Maintenance Manual chapter 10.

To prepare the engine for storage, check for correct oil level and add oil if necessary to bring the level to the full mark. Then, run the engine for at least five minutes at 1200 to 1500 RPM with oil and cylinder heat temperatures in the normal operating range. Shut down the engine.
Top up the fuel tanks to prevent condensation of water in the tanks.
If a dry hangar is not available, secure the aircraft as described above in this section (paragraph 8.9 c „Tie Down“).
Install covers over the cabin area to keep out moisture and sunlight.
Install the pitot tube cover.
To prevent oxidation of the finish, the use of light-colored slip covers over the composite fuselage during extended periods of outdoor tie-down, especially in summer time, is recommended.

After every seven days during storage, rotate the propeller by hand. After rotating the engine six revolutions, stop the propeller 60° to 120° from its former position.

WARNING !

Before rotating the propeller blades, make certain that the ignition switch is OFF, the throttle is closed and the mixture is in the IDLE CUT-OFF position. Always stand in the clear when turning the propeller.

If, at the end of 30 days, the aircraft will not be removed from storage, the engine should be started and run in a safe area. The preferred method is to fly the aircraft for 30 minutes.

For returning to service remove all covers, locks etc., and give the aircraft a thorough preflight inspection (see Section 4).

Approved Airplane Flight Manual

Model SA 160

LOG OF SUPPLEMENTS

Installed	No.	Title	Rev.	Date
☐	1	Garmin GNS 430 VHF Comm. Transceiver / VOR/ILS Receiver /GPS Receiver		March, 10, 05
☐	2	Garmin GNC 420 VHF Comm. Transceiver / GPS Receiver		March, 10, 05
☐	3	Garmin GMA 340 Audio Panel		March, 10, 05
☐	4	Garmin GTX 327 Transponder		March, 10, 05
☐	5	Bendix/King DME KN 62 A		March, 10, 05
☐	6	VM-100 Operation		March, 10, 05
☐	7	Parking Brake System		March, 10, 05

Airplane Flight Manual Supplement

Model SA 160

SUPPLEMENT 1

GARMIN GNS 430 VHF COMMUNICATIONS TRANSCEIVER / VOR/ILS RECEIVER / GPS RECEIVER

This supplement must be inserted into Section 9 of the Pilot's Operating Handbook and TC Approved Airplane Flight Manual when the GARMIN GNS 430 navigation system has been installed in accordance with GARMIN Installation Manual 190-00140-02 (Rev.A or later)
.
The Information contained herein supplements or supersedes the basic Pilot's Operating Handbook and TC Approved Airplane Flight Manual only in those areas listed in here. For limitations, procedures, and performance information not contained in this document, consult the basic Airplane Flight Manual.

Approved
Transport Canada

Date: ....

By: ....

Issued: Feb 25, 2005

LOG OF EFFECTIVE PAGES

The following Log of Effective Pages provides a listing of all effective pages in the Supplement, as well as the date of issue or revision.

Revision Level	Date of Issue
0 (Original Issue)	Feb 25, 2005

PAGE	DATE
Title	Feb 25, 2005
i	Feb 25, 2005
ii	Feb 25, 2005
1 of 16	Feb 25, 2005
2 of 16	Feb 25, 2005
3 of 16	Feb 25, 2005
4 of 16	Feb 25, 2005
5 of 16	Feb 25, 2005
6 of 16	Feb 25, 2005
7 of 16	Feb 25, 2005
8 of 16	Feb 25, 2005
9 of 16	Feb 25, 2005
10 of 16	Feb 25, 2005
11 of 16	Feb 25, 2005
12 of 16	Feb 25, 2005
13 of 16	Feb 25, 2005
14 of 16	Feb 25, 2005
16 of 16	

LIST OF REVISIONS

Rev. No.	Date	Page No.	Description	

SUPPLEMENT 1

TABLE OF CONTENTS

SECTION 1

GENERAL

1.1 INTRODUCTION

The GNS 430 System is a fully integrated, panel mounted instrument, which contains a VHF Communications Transceiver, a VOR/ILS receiver, and a Global Positioning System (GPS) Navigation computer. The primary function of the VHF Communication portion of the equipment is to facilitate communication with Air Traffic Control. The primary function of the VOR/ILS Receiver portion of the equipment is to receive and demodulate VOR, Localizer, and Glide Slope signals. The primary function of the GPS portion of the system is to acquire signals from the GPS system satellites, recover orbital data, make range and Doppler measurements, and process this information in real-time to obtain the user's position, velocity, and time.

1.2 SPECIFICATIONS

Provided the GARMIN GNS 430 's GPS receiver is receiving adequate usable signals, it has been demonstrated capable of and has been shown to meet the accuracy specifications for:

(a) VFR/IFR enroute, terminal, and non-precision instrument approach (GPS, Loran-C, VOR-DME, TACAN, NDB, NDB-DME, RNAV)operation within the U.S. National Airspace System in accordance with AC20-138.

(b) One of the approved sensors, for a single or dual GNS 430 installation, for North Atlantic Minimum Navigation Performance Specification (MNPS) Airspace in accordance with AC91-49 and AC120-33

(c)The systems meets RNP5 airspace (BRNAV)requirements of AC90-96 and in accordance with AC 20-138, and JAA AMJ 20X2 Leaflet 2 Revision 1, provided it is receiving usable navigation information from the GPS receiver.

(b)Navigation is accomplished using the WGS-84 (NAD83) coordinate reference datum. Navigation data is based upon use of only the Global Positioning System (GPS) operated by the United States of Amercia

SECTION 2

LIMITATIONS

2.1 GARMIN GNS 430 PILOT'S GUIDE

The GARMIN GNS 430 Pilot's Guide, P/N 190-00140-00, Rev. A, dated October, 1998, or later appropriate revision, must be immediately available to the flight crew whenever navigation is predicated on the use of the system.

2.2 SOFTWARE

The GNS 430 must utilize the following or later software versions:

Sub-System	**Software Version**
Main	2.00
GPS	2.00
COMM	1.22
VOR/LOC	1.25
G/S	2.00

The Main software version is displayed on the GNS 430 self test page immediately after turn-on for 5 seconds. The remaining system software versions can be verified on the AUX group sub-page 2, “SOFTWARE/ DATABASE VER”.

2.3 ENROUTE NAVIGATION (IFR)

IFR enroute and terminal navigation predicated upon the GNS 430's GPS Receiver is prohibited unless the pilot verifies the currency of the data base or verifies each selected waypoint for accuracy by reference to current approved data.

2.4 INSTRUMENT APPROACH (IFR)

Instrument approach navigation predicated upon the GNS 430's GPS Receiver must be accomplished in accordance with approved instrument approach procedures that are retrieved from the GPS equipment data base. The GPS equipment database must incorporate the current update cycle.

(a) Instrument approaches utilizing the GPS receiver must be conducted in the approach mode and Receiver Autonomous Integrity Monitoring (RAIM) must be available at the Final Approach Fix.

(b) Accomplishment of ILS, LOC, LOC-BC, LDA, SDF, and MLS or any other type of approach nor approved for GPS overlay with the GNS 430's GPS receiver is not authorized .

(c) Use of the GNS 430 VOR/ILS receiver to fly approaches not approved for GPS require VOR/ILS navigation data to be present on the external indicatore.

(d) When an alternate airport is required by the applicable operating rules, it must be served by an approach based on other than GPS or Loran-C navigation, the aircraft must have the operational equipment capable of using that navigation aid, and the required navigation aid must be operational.

(e) VANV information may be utilized for advisory information only. Use of VNAV information for Instrument Approach procedures does not guarantee Step-Down Fix altitude protection, or arrival at approach minimums in normal position to land.

2.5 DEFAULT SETTINGS

If not previously defined, the following default settings must be made in the "SET UP 1" menu of the GNS 430 prior to operation (refer to Pilot's Guide for procedure id necessary):

(a) dis, spd	nm, kts (sets navigation units to "nautical miles" and "knots")
(b) alt, Vv	ft, fpm (sets altitude units to "feet" and "feet per minute")
(c) map datum	WGS 84 (sets map datum to WGS-84, see note below)
(d) posn	deg-min (sets navigation grid units to decimal minutes)

Note: In some areas outside in United States, datums other than WGS-84 or NAD-83 may be used. If the GNS 430 is authorized for use by the appropriate Airworhiness authority, the required geodetic datum must be set in the GNS 430 prior to its use for navigation.

SECTION 3

EMERGENCY PROCEDURES

3.1 ABNORMAL PROCEDURES

(a) Missing or Invalid Navigation Information

If GARMIN GNS 430 navigation information is not available or invalid, utilize remaining operational navigation equipment as required.

(b) "RAIM POSITION WARNING"

If that message is displayed the system will flag and no longer provide GPS based navigational guidance. The crew should revert to the GNS 430 VOR/ILS receiver or an alternate means of navigation other than the GNS 430's GPS Receiver.

(c) "RAIM IS NOT AVAILABLE"

If that message is displayed in the enroute, terminal, or initial approach phase of flight, continue to navigate using the GPS equipment or revert to an alternate means of navigation other than the GNS 430's GPS receiver appropriate to the route and phase of flight. When continuing to use GPS navigation, position must be verified every 15 minutes using the GNS 430's VOR/ILS receiver or another IFR-approved navigation system.

(d)"RAIM IS NOT AVAILABLE"on the Final Approach

If that message is display while on the final approach segment, GPS based navigation will continus for up to 5 minutes with approach CDI sensitivity (0.3 nautical mile).After 5 minutes the system will flag and no longer provide course guidance with approach sensitivity. Missed approach course guidance may still be available with 1 nautical mile CDI sensitivity by executing the missed approach.

(e) Emergency Frequency of 121.500 MHz

In an in-flight emergency, depressing and holding the Comm transfer button for 2 seconds will select the emergency frequency of 121.500 MHz into the "Active" frequency window.

SECTION 4

NORMAL PROCEDURES

Normal operating procedures are completely described in the GARMIN GNS 430 Pilot's Guide, P/N 190-00140-00, Rev. A, dated October 1998, or later appropriate revision.

NOTE: The GNS 430 is shown in figure 7-1.

4.1 POWERING ON THE GNS 430

(a) Rotate the Com power/volume knob clockwise to turn the unit on and set the desired radio volume.

(b) A welcome page appears briefly and the unit will conduct a self-test to ensure proper operation.

(c) Once the self-test concludes, the database confirmation page is displayed, showing the effective and expiration dates of the Jeppesen database on the NavData card. Press ENT to acknowledge the database page and proceed to the instrument panel self-test page.

(d) The instrument panel self-test page allows you to verify that the GNS 430 is communicating properly with in-panel instruments. Compare on-screen indications with the information depicted on connected instruments, such as the CDI, HIS, RMI and/or external annunciators. Once you have verified proper operation, press ENT to display the Satellite Status Page.

(e) Rotate the small right knob to select the desired page in the NAV Group.

4.2 FREQUENCY SELECTION

(a) If the tuning cursor is not currently in the desired window (COM or VLOC), press the small left knob momentarily.

(b) Rotate the large left knob to select the desired megahertz (MHz) value.

(c) Rotate the small left knob to select the desired kilohertz (kHz) value.

(d) To activate the selected frequency, press the corresponding flip-flop key C for COM frequencies or V for VLOC frequencies.

4.3 DATA ENTRY

(a) Data is entered in the GPS window using the large and small right knobs. The large right knob is used to move the cursor about the page. The small right knob is used to select individual characters for the highlighted cursor location.

4.4 PAGE SELECTION

(a) Selection of any main page is performed using the large and small right knobs. The large right knob selects the page group: NAV, WPT or AUX. The small right knob selects the desired page within a group. To quickly select the default NAV page, press and hold CLR .

4.5 TO SELECT A DIRECT-TO DESTINATION

(a) Press the -D→ key. A select direct to waypoint page will appear, with the waypoint identifier field highlighted.

(b) Use the small PUSH CRSR and large PUSH CRSR right knobs to enter the identifier of the desired destination waypoint.

(c) Press ENT to confirm the selected waypoint, and ENT to activate the direct-to function.

4.6 TO SELECT A NEARBY AIRPORT AS A DIRECT-TO DESTINATION

(a) Press -D→ to display the select direct-to waypoint page.

(b) Rotate the large right knob PUSH CRSR to place the flashing cursor on the nearest airport (NRST) field.

(c) Rotate the small right knob PUSH CRSR to display a window, listing up to nine nearest airports.

(d) Continue rotating the small right knob PUSH CRSR to highlight the desired airport.

(e) Press ENT to accept the selected waypoint's identifier and press ENT a second time (with "Activate?" highlighted) to begin navigating to the selected waypoint.

4.7 GNS 430 INTEGRATION

The GNS 430 system is integrated into the aircraft avionics installation in two configurations:

(a) Single GNS 430 (GPS 1) interfaced with the CDI (VOR/LOC/ILS/GS Indicator) and a single GNC 420 (GPS 2) not integrated with a remote indicator.

(b) Single GNS 430 (GPS 1)interfaced with the CDI (VOR/LOC/ILS/GS Indicator) and a single GNC 420 (GPS 2) interfaced with a second CDI (VOR/LOC Indicator).

In both configurations, pressing the CDI push-button on the GNS 430 alternately selects GPS or NAV for display on the CDI each time the button is pressed. The CDI source is indicated by illumination of the "GPS" or "VLOC" annunciation in the lower left corner of the GNS 430 display.

When VLOC is selected for display, the CDI displays course deviation from a VOR, Localizer (LOC) or Glideslope (G/S), and GPS truck deviation when GPS is selected.

SECTION 5

PERFORMANCE

No change.

SECTION 6
WEIGHT AND BALANCE

Factory installed optional equipment is included in the licensed weight and balance data in the paperwork delivered with the aircraft.

SECTION 7

DESCRIPTION AND OPERATION

7.1 GENERAL

The information contained in here supersedes the information on the Bendix/King KX 125 VHF NAV/COM receiver-transmitter, provided in the Description & Operation Section of the basic Pilot's Operating Handbook and TC Approved Airplane Flight Manual.

For a complete description of the GNS 430 system, refer to the GARMIN GNS 430 Pilot's Guide, P/N 190-00140-00, Rev. A, dated October, 1998, or later appropriate revision.

7.2 SYSTEM DESCRIPTION

The GNS 430 system consists primarily of the GNS 430 unit, a GPS antenna, a VHF VOR/LOC/GS antenna, and a VHF COMM antenna.

The GNS 430 unit contains the GPS Receiver, the VOR/ILS receiver, and the VHF Communications Transceiver. The unit is mounted in the center of instrument panel; in the avionics column.

The GNS 430 system can be turned ON if the BAT switch and the AVIONICS switch are in the ON position.

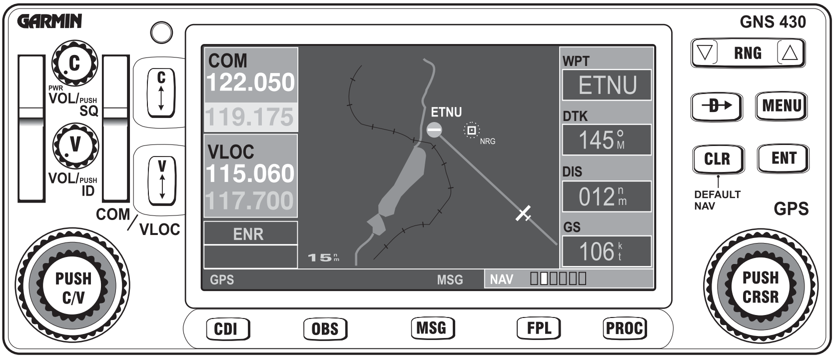


Figure 7-1
Front View of the GNS 430 Unit

(a) Key and Knob Functions

(1) Left-hand Keys and Knobs

The COM power/volume knob  controls unit power and communications radio volume. Press momentarily to enable/disable automatic squelch control.

The VLOC volume knob  controls audio volume for the selected VOR/ Localizer frequency. Press momentarily to enable/disable the ident tone.

The large left knob  is used to tune the megahertz (MHz) value of the standby frequency for the COM transceiver or the VLOC receiver, whichever is currently selected by the tuning cursor.

The small left knob  is used to tune the kilohertz (kHz) value of the standby frequency for the COM transceiver or the VLOC receiver, whichever is currently selected by the tuning cursor. Press this knob momentarily to toggle the tuning cursor between the COM and VLOC windows.

The COM flip-flop key is used to swap the active and standby COM frequencies. Press and hold to select emergency channel (121.500 MHz).

The VLOC flip-flop key is used to swap the active and standby VLOC frequencies (i.e., make the selected standby frequency active).

(2) Right-hand Keys and Knobs

The range key allows selecting the desired map scale. Use the up arrow side of the key to zoom out or the down arrow side to zoom in.

The direct-to key allows entering a destination waypoint and establishing a direct course to the selected destination.

The menu key displays a context-sensitive options list. The options list allows making settings changes which relate to the currently displayed page.

The clear key is used to erase information or cancel an entry. Press and hold this key to immediately display the Default NAV Page.

The enter key is used to approve an operation or complete data entry. It is also used to confirm information, such as during power on.

The large right knob is used to select between the various Page groups: NAV, WPT AUX or NRST. With the on-screen cursor enabled, the large right knob allows moving the cursor about the page.

The small right knob is used to select between the various pages within one of the groups listed above. Press this knob momentarily to display the on-screen cursor. The cursor allows entering data and/or making a selection from a list of options.

(3) Bottom Row Keys

The CDI key CDI is used to toggle which navigation source (GPS or VLOC) provides output to an external HSI or CDI.

The OBS key OBS is used to select manual or automatic sequencing of waypoints. Pressing the OBS key selects OBS mode, which will retain the current "active to" waypoint as the navigation reference even after passing the waypoint (i.e., prevents sequencing to the next waypoint). Pressing the OBS key again will return to normal operation, with automatic sequencing of waypoints. Whenever OBS mode is selected, the user may set the desired course to/from a waypoint using the OBS Page, or an external OBS selector on the HSI or CDI.

The message key MSG is used to view system messages and to alert the pilot to important warnings and requirements.

The flight plan key FPL allows creating, editing, activating and inverting flight plans, as well as access approaches, departures and arrivals. A closest point to flight plan feature is also available from the flight plan key.

The procedures key PROC allows selecting approaches, departures and arrivals from the active flight plan. When using a flight plan, available procedures for departure and/or arrival airport are offered automatically. Otherwise, the user may select the desired airport, then the desired procedure.

(b) Screen Areas

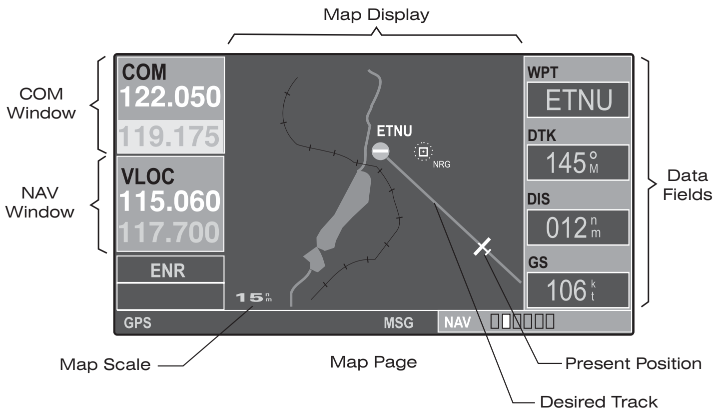


Figure 7-2
Screen Areas (Map Page)

(c) NavData Card Slots

There are two data card slots on the face of the GNS 430.
The Jeppesen NavData card should be inserted in the left-most slot. The second slot is provided for future options and expansion capabilities. Insert the card with the swing arm handle at the bottom and the label facing to left.

Symphony AIRCRAFT

Quebec, Canada

Airplane Flight Manual Supplement

Model SA 160

SUPPLEMENT 2

GARMIN GNC 420 VHF COMMUNICATIONS TRANSCEIVER / GPS RECEIVER

This supplement must be inserted into Section 9 of the Pilot's Operating Handbook and TC Approved Airplane Flight Manual when the GARMIN GNS 430 navigation system has been installed in accordance with GARMIN Installation Manual 190-00140-02 (Rev.A or later)
.
The Information contained herein supplements or supersedes the basic Pilot's Operating Handbook and TC Approved Airplane Flight Manual only in those areas listed in here. For limitations, procedures, and performance information not contained in this document, consult the basic Airplane Flight Manual.

Date: ....

Approved
Transport Canada

By: ....

Issued: Feb 25, 2005

LOG OF EFFECTIVE PAGES

The following Log of Effective Pages provides a listing of all effective pages in the Supplement, as well as the date of issue or revision.

Revision Level	Date of Issue
0 (Original Issue)	Feb 25, 2005

PAGE	DATE
Title	Feb 25, 2005
i	Feb 25, 2005
ii	Feb 25, 2005
1 of 15	Feb 25, 2005
2 of 15	Feb 25, 2005
3 of 15	Feb 25, 2005
4 of 15	Feb 25, 2005
5 of 15	Feb 25, 2005
6 of 15	Feb 25, 2005
7 of 15	Feb 25, 2005
8 of 15	Feb 25, 2005
9 of 15	Feb 25, 2005
10 of 15	Feb 25, 2005
11 of 15	Feb 25, 2005
12 of 15	Feb 25, 2005
13 of 15	Feb 25, 2005
14 of 15	Feb 25, 2005

LIST OF REVISIONS

Rev. No.	Date	Page No.	Description	

SUPPLEMENT 2

TABLE OF CONTENTS

SECTION 1

GENERAL

1.1 INTRODUCTION

The GNC 420 System is a fully integrated, panel mounted instrument, which contains a VHF Communications Transceiver and a Global Positioning System (GPS) Navigation computer. The system consists of a GPS antenna, GPS Receiver, VHF COMM antenna and a VHF Communications Transceiver. The primary function of the VHF Communication portion of the equipment is to facilitate communication with Air Traffic Control. The primary function of the GPS portion of the system is to acquire signals from the GPS system satellites, recover orbital data, make range and Doppler measurements, and process this information in real-time to obtain the user's position, velocity, and time.

1.2 SPECIFICATIONS

Provided the GARMIN GNC 420 's GPS receiver is receiving adequate usable signals, it has been demonstrated capable of and has been shown to meet the accuracy specifications for:

(a) VFR/IFR enroute, terminal, and non-precision instrument approach (GPS, Loran-C, VOR, VOR-DME, TACAN, NDB, NDB-DME, RNAV)operation within the U.S. National Airspace System in accordance with AC20-138.

(b) One of the approved sensors, for a single or dual GNC 420 installation, for North Atlantic Minimum Navigation Performance Specification (MNPS) Airspace in accordance with AC91-49 and AC120-33

(c)The systems meets RNP5 airspace (BRNAV)requirements of AC90-96 and in accordance with AC 20-138, and JAA AMJ 20X2 Leaflet 2 Revision 1, provided it is receiving usable navigation information from the GPS receiver.

(b)Navigation is accomplished using the WGS-84 (NAD83) coordinate reference datum. Navigation data is based upon use of only the Global Positioning System (GPS) operated by the United States of Amercia

SECTION 2

LIMITATIONS

2.1 GARMIN GNC 420 PILOT'S GUIDE

The GARMIN GNC 420 Pilot's Guide, P/N 190-00140-20, Rev. A, dated July 1999, or later appropriate revision, must be immediately available to the flight crew whenever navigation is predicated on the use of the system.

2.2 SOFTWARE

The GNC 420 must utilize the following or later software versions:

Sub-System	**Software Version**
Main	2.08
GPS	2.00
COMM	2.00

The Main software version is displayed on the GNC 420 self test page immediately after turn-on for 5 seconds. The remaining system software versions can be verified on the AUX group sub-page 2, “SOFTWARE/DATABASE VER”

2.3 ENROUTE NAVIGATION

IFR enroute and terminal navigation predicated upon the GNC 420's GPS Receiver is prohibited unless the pilot verifies the currency of the data base or verifies each selected waypoint for accuracy by reference to current approved data.

2.4 INSTRUMENT APPROACH

Instrument approach navigation predicated upon the GNC 420's GPS Receiver must be accomplished in accordance with approved instrument approach procedures that are retrieved from the GPS equipment data base. The GPS equipment database must incorporate the current update cycle.

(a) Instrument approaches utilizing the GPS receiver must be conducted in the approach mode and Receiver Autonomous Integrity Monitoring (RAIM) must be available at the Final Approach Fix.

(b) Accomplishment of ILS, LOC, LOC-BC, LDA, SDF, MLS or any others type of approach not approved for GPS overlay with the GNC 420's GPS reveiver is not authorized.

(c) When an alternate airport is required by the applicable operating rules, it must be served by an approach based on other than GPS or LORAN-C navigation, the aircraft must have the operational equipment capable of using that navigation aid, and the required navigation aid must be operational.

(d) VANV information may be utilized for advisory information only. Use of VNAV information for Instrument Approach procedures does not guarantee Step-Down Fix altitude protection, or arrival at approach minimums in normal position to land.

2.5 DEFAULT SETTINGS

If not previously defined, the following default settings must be made in the "SET UP 1" menu of the GNC 420 prior to operation (refer to Pilot's Guide for procedure if necessary):

(a) dis, spd	nm, kts (sets navigation units to "nautical miles" and "knots")
(b) alt, Vv	ft, fpm (sets altitude units to "feet" and "feet per minute")
(c) map datum	WGS 84 (sets map datum to WGS-84, see note below)
(d) posn	deg-min (sets navigation grid units to decimal minutes)

Note: In some areas outside in United States, datums other than WGS-84 or NAD-83 may be used. If the GNC 420 is authorized for use by the appropriate Airworhiness authority, the required geodetic datum must be set in the GNC 420 prior to its use for navigation.

SECTION 3

EMERGENCY PROCEDURES

3.1 ABNORMAL PROCEDURES (IFR)

(a) Missing or Invalid Navigation Information

If GARMIN GNC 420 navigation information is not available or invalid, utilize remaining operational navigation equipment as required.

(b) "RAIM POSITION WARNING"

If that message is displayed the system will flag and no longer provide GPS based navigational guidance. The crew should revert to an alternate means of navigation other than the GNC 420's GPS Receiver.

(c) "RAIM IS NOT AVAILABLE"

If that message is displayed, continue to navigate using the GPS equipment or revert to an alternate means of navigation other than the GNC 420's GPS receiver appropriate to the route and phase of flight. When continuing to use GPS navigation, position must be verified every 15 minutes using another IFR-approved navigation system.

(d)"RAIM IS NOT AVAILABLE"on the Final Approach

If that message is display while on the final approach segment, GPS based navigation will continus for up to 5 minutes with approach CDI sensitivity (0.3 nautical mile).After 5 minutes the system will flag and no longer provide course guidance with approach sensitivity. Missed

approach course guidance may still be available with 1 nautical mile CDI sensitivity by executing the missed approach.

(e) Emergency Frequency of 121.500 MHz

In an in-flight emergency, depressing and holding the Comm transfer button for 2 seconds will select the emergency frequency of 121.500 MHz into the "Active" frequency window.

SECTION 4
NORMAL PROCEDURES

Normal operating procedures are completely described in the GARMIN GNC 420 Pilot's Guide, P/N 190-00140-20, Rev. A, dated July 1999, or later appropriate revision.

NOTE: The GNC 420 is shown in figure 7-1.

4.1 POWERING ON THE GNC 420

(a) Rotate the Com power/volume knob C clockwise to turn the unit on and set the desired radio volume.

(c) A welcome page appears briefly and the unit will conduct a self-test to ensure proper operation. During the self-test check for:

(1) CDI-halfleft/ no flag
(2) G/S-half/ no flag
(3) TO/From flag-to
(4) Bearing to-135°

(5) Time To-4 minutes)
(6) Distance to-10.0 nm
(7) Ground Speed-150 kts
(8) Ext.Annunciators-ON

(c) Once the self-test concludes, the database page will appear, showing the effective and expiration dates of the Jeppesen database on the NavData card.

(d) Press ENT to acknowledge the database page and proceed to the instrument panel self-test page.

(f) Rotate the small right knob to select the desired page in the NAV Group.

4.2 COM FREQUENCY SELECTION

(a) Rotate the large left knob to select the desired megahertz (MHz) value.

(b) Rotate the small left knob to select the desired kilohertz (kHz) value.

(c) To activate the selected frequency, press the flip-flop key .

4.3 DATA ENTRY

(a) The GPS window cursor is used to select the desired fields. Press the small right knob to activate the cursor. Press again to deactivate it. The large right knob is used to move the cursor about the page. The small right knob is used to select individual characters for the highlighted cursor location.

Feb 25, 2005

4.4 PAGE SELECTION

(a) Selection of any main page is performed using the large and small right knobs. The large right knob selects the page group: NAV, WPT orAUX. The small right knob selects the desired page within a group. To quickly select the default NAV page, press and hold CLR .

4.5 TO SELECT A DIRECT-TO DESTINATION

(a) Press the -D-> key. A select direct to waypoint page will appear, with the waypoint identifier field highlighted.

(b) Use the small and large right knobs to enter the identifier of the desired destination waypoint.

(c) Press ENT to confirm the selected waypoint, and ENT to activate the direct-to function.

4.6 TO SELECT A NEARBY AIRPORT AS A DIRECT-TO DESTINATION

(a) Press -D-> to display the select direct-to waypoint page.

(b) Rotate the large right knob to place the flashing cursor on the nearest airport (NRST) field.

(c) Rotate the small right knob to display a window, listing up to nine nearest airports.

(d) Continue rotating the small right knob to highlight the desired airport.

(e) Press ENT to accept the selected waypoint's identifier and press ENT a second time (with "Activate?" highlighted) to begin navigating to the selected waypoint.

4.7 GNC 420 Integration

The GNC 420 system is integrated into the aircraft avionics installation in two configurations:

(a) Single GNS 430 (GPS 1) interfaced with the CDI (VOR/LOC/ILS/GS Indicator) and a single GNC 420 (GPS 2) not integrated with a remote indicator.

(b) Single GNS 430 (GPS 1)interfaced with the CDI (VOR/LOC/ILS/GS Indicator) and a single GNC 420 (GPS 2) interfaced with a second CDI (VOR/LOC Indicator).
In this configuration GNC 420 GPS course information is displayed on the second CDI.

SECTION 5

PERFORMANCE

No change.

SECTION 6

WEIGHT AND BALANCE

Factory installed optional equipment is included in the licensed weight and balance data in the paperwork delivered with the aircraft.

SECTION 7

DESCRIPTION AND OPERATION

7.1 GENERAL

The information contained in here supersedes the information on the Bendix/King KX 125 VHF NAV/COM receiver-transmitter, provided in the Description & Operation Section of the basic Pilot's Operating Handbook and TC Approved Airplane Flight Manual.

For a complete description of the GNC 420 system, refer to the GARMIN GNC 420 Pilot's Guide, P/N 190-00140-20, Rev. A, dated July 1999, or later appropriate revision.

7.2 SYSTEM DESCRIPTION

The GNC 420 system consists primarily of the GNC 420 unit, a GPS antenna, and a VHF COMM antenna.

The GNC 420 unit contains the GPS Receiver and the VHF Communications Transceiver. The unit is mounted in the center of instrument panel; in the avionics column.

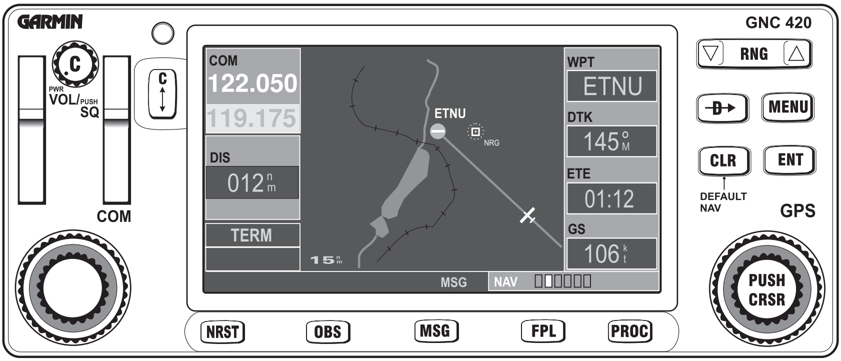


Figure 7-1
Front View of the GNC 420 Unit

(a)Key and Knob Functions

(1)Unit Keys and Knobs(Excluding bottom row)

The COM power/volume knob  controls unit power and communications radio volume. Press momentarily to enable/disable automativ squelch control.

The large left knob  is used to tune the megahertz (MHz) value of the stanby frequency for the COM transceiver.

The small left knob  is usedto tuned the kilohertz (kHz)value of the stanby frequency for the COM transceiver.

The COM flip-flop key is used to swap the active and stanby COM frequencies. Press and hold to select emergency channel (121.500 MJz).

The range key allows selecting the desired mape scale. Use the up arrow side of the key to zoom out or the down arrow side to zoom in.

The direct-to key allows entering a destination waypoint and establishing a direct course to the selected destination.

The menu key displays a context-sensitive options list. The options list allows making settings changes which relate to the currently displayed page.

The clear key is used to erase information or cancel an entry. Press and hold this key to immediately display the Default NAV Page.

The enter key is used to approve an operation or complete data entry. It is also used to confirm information, such as during power on.

The large right knob is used to select between the various Page groups: NAV, WPT or AUX. With the on-screen cursor enabled, the large right knob allows moving the cursor about the page.

The small right knob is used to select between the various pages within one of the groups listed above. Press this knob momentarily to display the on-screen cursor. The cursor allows entering data and/or making a selection from a list of options.

(2) Bottom Row Keys

The NRST key displays the nearest airport page. Then, rotating the small right knob steps through the NRST Pages.

The OBS key is used to select manual or automatic sequencing of waypoints. Pressing the OBS key selects OBS mode, which will retain the current "active to" waypoint as the navigation reference even after passing the waypoint (i.e., prevents sequencing to the next waypoint). Pressing the OBS key again will return to normal operation, with automatic sequencing of waypoints. Whenever OBS mode is selected, the user may set the desired course to/from a waypoint using the OBS Page, or an external OBS selector on your HSI or CDI.

The message key is used to view system messages and to alert the pilot to important warnings and requirements.

The flight plan key allows creating, editing, activating and inverting flight plans, as well as access approaches, departures and arrivals. A closest point to flight plan feature is also available from the flight plan key.

The procedures key allows selecting approaches, departures and arrivals from the active flight plan. When using a flight plan, available procedures for departure and/or arrival airport are offered automatically. Otherwise, the user may select the desired airport, then the desired procedure.

(b) Screen Areas

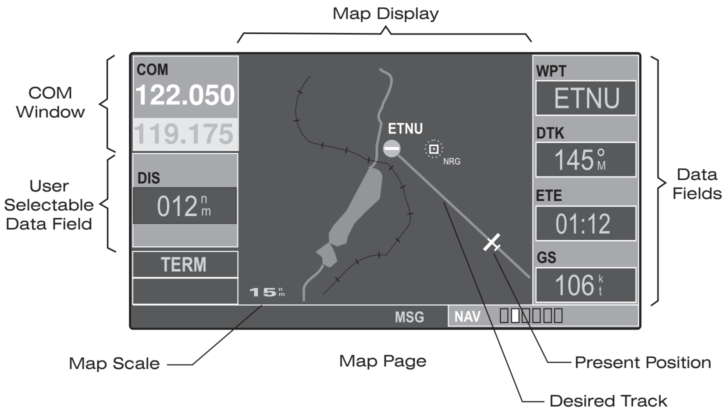


Figure 7-2
Screen Areas (Map Page)

(c) NavData Card Slots

There are two data card slots on the face of the GNC 420.
The Jeppesen NavData card should be inserted in the left-most slot. The second slot is provided for future options and expansion capabilities. Insert the card with the swing arm handle at the bottom and the label facing to left.

Airplane Flight Manual Supplement

Model SA 160

SUPPLEMENT 3

GARMIN GMA 340 AUDIO PANEL

This supplement must be inserted into Section 9 of the Pilot's Operating Handbook and TC Approved Airplane Flight Manual when the GARMIN GMA 340 Audio Panel has been installed.

The Information contained herein supplements or supersedes the basic Pilot's Operating Handbook and TC Approved Airplane Flight Manual only in those areas listed herein. For limitations, procedures, and performance information not contained in this document, consult the basic Airplane Flight Manual.

Date: ....

Approved
Transport Canada

By: ....

Issued: Feb 25, 2005

LOG OF EFFECTIVE PAGES

The following Log of Effective Pages provides a listing of all effective pages in the Supplement, as well as the date of issue or revision.

Revision Level	Date of Issue
0 (Original Issue)	Feb 25, 2005

PAGE	DATE
Title	Feb 25, 2005
i	Feb 25, 2005
ii	Feb 25, 2005
1 of 11	Feb 25, 2005
2 of 11	Feb 25, 2005
3 of 11	Feb 25, 2005
4 of 11	Feb 25, 2005
5 of 11	Feb 25, 2005
6 of 11	Feb 25, 2005
7 of 11	Feb 25, 2005
8 of 11	Feb 25, 2005
9 of 11	Feb 25, 2005
10 of 11	Feb 25, 2005
11 of 11	Feb 25, 2005

LIST OF REVISIONS

Rev. No.	Date	Page No.	Description	

SUPPLEMENT 3

TABLE OF CONTENTS

SECTION 1

GENERAL

1.1 INTRODUCTION

The Garmin GMA 340 Audio Panel provides audio amplification, audio selection, marker beacon control, and a voice activated intercom system for the headsets and microphones.
The system allows audio switching for up to three transceivers (COM 1,COM 2, and COM 3) and five receivers (NAV 1, NAV 2, ADF, DME, and MKR). A fail-safe mode connects the pilot headphone and microphone to COM 1 if power is removed or if the Mic Selector switch is turned to the OFF position.

1.2 SPECIFICATIONS

(a) General

Physical dimensions:	Length 6.4"
	Width: 6.29"
	Height: 1.3"
Power Requirements:	
Supply voltage:	11-33 Vdc
Operating current:	2.2A (13.8V, spkr on)
Temperature range:	-20°C to +55°C (normal operation)
Altitude:	50,000 MSL unpressurized

(b) Audio Panel

Transceiver inputs:	3
Receiver inputs:	5
Unswitched inputs:	2
Input impedance:	500 ohms
Input isolation:	60 dB min

(c) Intercom

Volume controls:	3 (pilot, copilot, passengers)
VOX level controls:	2 (pilot, copilot/passengers)
VOX circuits:	6 (one per mic input)
Music inputs (stereo):	2 (one input mutable)
Intercom isolation modes:	3 (pilot, crew, all)

(d) Headphone Outputs

Output amplifiers:	3, stereo (pilot, copilot, passengers)
Power:	100 mW per stereo channel, each headset, into 150 ohms with not more than 5% distortion, any normal supply voltage.
Frequency response:	Music: 100 Hz to 15 kHz nom
A/C radio:	100 Hz to 6 kHz nom
ICS mic:	(Special cabin noise band de-emphasis)

SECTION 2
LIMITATIONS

No change.

SECTION 3
EMERGENCY PROCEDURES

3.1 ABNORMAL PROCEDURES

(a) Failsafe Operation

A failsafe circuit connects the pilot's headset and microphone directly to COM 1 in case the power is interrupted or the GMA 340 unit is turned off.

SECTION 4
NORMAL PROCEDURES

Normal operating procedures are completely described in the GARMIN GMA 340 Audio Panel Pilot's Guide, P/N 190-00149-10, Rev. A, or later appropriate revision.

NOTE: The GMA 340 Audio Panel is shown in figure 7-1.

4.1 POWERING ON THE GMA 340

To turn the unit on, rotate the left small knob 

clockwise past the click.

4.2 SELECT A TRANSCEIVER

Press either COM 1 MIC, COM 2 MIC, or COM 3 MIC COMx MIC button for selection of either COM 1, COM 2, or COM 3 COMx for both MIC and audio source. The active com audio is always heard on the headphones.

Additionally, each audio source can be selected independently by pressing COM 1, COM 2, or COM 3 COMx . When selected in this way, they remain active as audio sources regardless of which transceiver has been selected for microphone use.

4.3 SELECT THE INTERCOM MODE

To activate other then ALL mode, press CREW or PILOT button.
Press again to deactivate the mode.
The operator can switch directly from PILOT to CREW or from CREW to PILOT by pressing the other mode button. The ALL mode is active when neither PILOT nor CREW LED are lit.

4.4 ADJUSTING INTERCOM VOLUME AND SQUELCH

(a) LEFT SMALL KNOB PILOT - Unit ON/OFF power control and pilot ICS volume. Full counterclockwise detent position is OFF

(b) LEFT LARGE KNOB - Pilot ICS mic VOX squelch level. Clockwise rotation increases the amount of mic audio (VOX level) required to break squelch. Full counterclockwise is the "HOT MIC" position.

(c) RIGHT SMALL KNOB - Copilot ICS volume.

(d) RIGHT LARGE KNOB - Copilot mic VOX squelch level. Clockwise rotation increases the amount of mic audio (VOX level) required to break squelch. Fully counterclockwise is the "HOT MIC" position.

NOTE: Audio level is always controlled be the selected COM or NAV radio volume.

4.5 SELECT SPLIT COM MODE

Press the COM 1/2 button to activate the Split COM function. When this mode is active, COM 1 is dedicated solely to the pilot for MIC/audio while COM 2 is dedicated to the copilot for MIC/ audio. The pilot and copilot can simultaneously transmit in this mode over separate radios. Both pilots can still listen to COM 3, NAV 1, NAV 2, DME, ADF, and MKR as selected. The Split COM mode is canceled by pressing the COM 1/2 button a second time.

4.6 SELECT A NAV AUDIO SOURCE

Press NAV 1, NAV 2, DME, ADF , or MKR to select each audio source. A second button press deselects the audio.

SECTION 5
PERFORMANCE

No change.

SECTION 6
WEIGHT AND BALANCE

Factory installed optional equipment is included in the licensed weight and balance data in the paperwork delivered with the aircraft.

SECTION 7
DESCRIPTION AND OPERATION

7.1 GENERAL

The information contained herein supersedes the information on the intercom system, provided in the Description & Operation Section of the basic Pilot's Operating Handbook and TC Approved Airplane Flight Manual.

For a complete description of the GMA 340 Audio Panel, refer to the GARMIN GMA 340 Audio Panel Pilot's Guide, P/N 190-00149-10, Rev. A, or later appropriate revision.

7.2 SYSTEM DESCRIPTION

The GMA 340 intercom system consists primarily of the GMA 340 audio control unit, located on the instrument panel, center-high, the pilot and Co-pilot audio jacks mounted on the middle console, and the Push-To-Talk switches located on the control sticks.

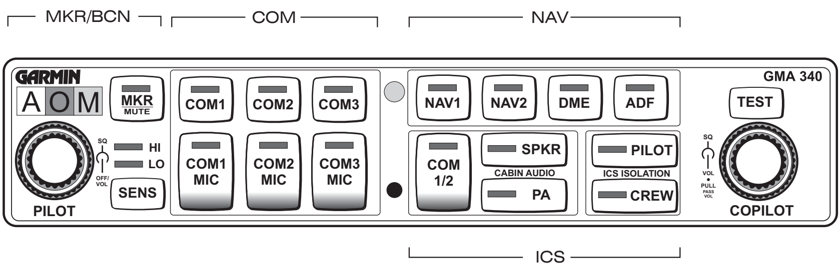


Figure 7-1
Front View of the GMA 340 Unit

7.3 KEY AND KNOB FUNCTIONS

The left small knob  controls ON/OFF function.

 Marker Beacon Lamps

MKR  Marker Beacon Receiver Audio Select/Mute Button

MKR	HI LO	Marker Beacon Receiver Sensitivity Indicator LEDs
	SENS	Marker Beacon Receiver Sensitivity Selection Button
	PILOT	Pilot Intercom System (ICS) Volume
	PILOT	Pilot ICS Voice Activated (VOX) Intercom Squelch Level
ICS	COPILOT	Copilot ICS Volume Control
	COPILOT	Copilot VOX Intercom Squelch Level
	CREW	Crew, Isolation Intercom Mode Button
	PILOT	Pilot Isolation Intercom Mode Button
	PA	Passenger Address (PA) Function Button (n.a.)
	SPKR	Speaker Function Button
	COMx	Transceiver Audio Selector Buttons (COM 1, COM 2, COM 3)
	COMx MIC	Transmitter (Audio/Mic) Selection Buttons
COM/ NAV	COM 1/2	Split COM Button
	NAVx DME ADF	Aircraft Radio Audio Selection Buttons (NAV 1, NAV 2, DME, ADF)

TEST Annunciator Test Button

● Locking Screw Access

○ Photocel-Automatic Annunciator Dimming

7.4 ICS MODES

(a) PILOT mode isolates the pilot from everyone else and dedicates the aircraft radios to the pilot exclusively. The copilot and passengers share communication between themselves but cannot communicate with the pilot or hear the aircraft radios.
(b) CREW mode places the pilot and copilot on a common ICS communication channel.
(c) ALL mode allows full intercom communication between everyone plugged in to the GMA 340. Aircraft radios are heard by all.
(d) MUSIC 1 and MUSIC 2 stereo entertainment inputs are affected by the intercom mode selected.

7.5 MARKER BEACON RECEIVER

The marker beacon audio level is aligned at the factory to produce its rated audio output. However, the output level is adjustable by your avionics installing agency.

The GMA 340's marker beacon receiver controls are located on the left side of the front panel. The SENS button SENS selects either high or low sensitivity as indicated by the HI or LO LED being lit. Low sensitivity is used on ILS approaches while high sensitivity allows operation over airway markers or to get an earlier indication of nearing the outer marker during an approach.

The marker audio is selected initially by pressing the MKR/mute button 

. If no marker beacon signal is received, then pressing again will deselect the marker audio. This operation is similar to selecting any other audio source on the GMA 340. However, if the second button press occurs while a marker beacon signal is received, then the marker audio is muted but not deselected. The button's LED will remain lit to indicate that the source is still selected.

The GMA 340's ***SmartMute***™ function then monitors the marker signal and automatically unmutes the audio when the current marker signal is no longer being received.

In all cases, the marker beacon lamps operate independently of any audio selection and cannot be turned off. The GMA 340 can drive external marker lamps if required.

Symphony AIRCRAFT

Quebec, Canada

Airplane Flight Manual Supplement

Model SA 160

SUPPLEMENT 4

GARMIN GTX 327 MODE A/C TRANSPONDER

This supplement must be inserted into Section 9 of the Pilot's Operating Handbook and TC Approved Airplane Flight Manual when the GARMIN GTX 327 Transponder has been installed.
The Information contained herein supplements or supersedes the basic Pilot's Operating Handbook and TC Approved Airplane Flight Manual only in those areas listed herein. For limitations, procedures, and performance information not contained in this document, consult the basic Airplane Flight Manual.

Date: ....

Approved
Transport Canada

By: ....

Issued: Feb 25, 2005

LOG OF EFFECTIVE PAGES

The following Log of Effective Pages provides a listing of all effective pages in the Supplement, as well as the date of issue or revision.

Revision Level	Date of Issue
0 (Original Issue)	Feb 25, 2005

PAGE	DATE
Title	Feb 25, 2005
i	Feb 25, 05
ii	Feb 25, 05
1 of 8	Feb 25, 05
2 of 8	Feb 25, 05
3 of 8	Feb 25, 05
4 of 8	Feb 25, 05
5 of 8	Feb 25, 05
6 of 8	Feb 25, 05
7 of 8	Feb 25, 05
8 of 8	Feb 25, 05

LIST OF REVISIONS

Rev. No.	Date	Page No.	Description	

SUPPLEMENT 4

TABLE OF CONTENTS

SECTION 1

GENERAL

1.1 INTRODUCTION

The Garmin GTX 327 Transponder, located mid-avionics panel, receives interrogations from a ground based secondary radar transmitter and transmits the aircraft's identification to the Air Traffic Control Center via Mode A transmissions and altitude information via Mode C.

1.2 SPECIFICATIONS

Power Requirements:	11.0 to 33.0 Vdc; Power Input 15 W typical
Transmitter Frequency:	1090 MHz
Transmitter Power:	150 W Nominal
Receiver Frequency:	1030 MHz
Receiver Sensitivity:	-72 dBm Nominal
Mode A Capability:	4096 Identifications Codes
Mode B CapabilityÊ:	100 Foot Increments from -1000 to 63,000 feet
GTX Unit Weight:	2.39 lbs.
Altitude:	50,000 feet

SECTION 2
LIMITATIONS

No change.

SECTION 3
EMERGENCY PROCEDURES

No change.

SECTION 4
NORMAL PROCEDURES

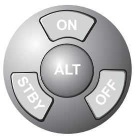
Normal operating procedures are completely described in the GARMIN GTX 327 Mode A/C Transponder Pilot's Guide, P/N 190-00187-00, Rev. A, or later appropriate revision.

NOTE: The GTX 327 Mode A/C Transponder is shown in figure 7-1.

4.1 POWERING ON THE GTX 327

Place BAT and AVIONIC switches in ON position (VFR). Place BAT and AVIONIC 1 switches in ON position (IFR). The transponder will turn on in the standby mode. After power on a start-up page will be displayed while the unit performs a self test.

4.2 SELECT A TRANSPONDER MODE



(a) To select the standby mode press STBY key;
Powers on the transponder in standby mode. At power on the last active identification code will be selected. When in standby mode, the transponder will not reply to any interrogations,

(b) To select the Mode A press the ON key;
Powers on the transponder in Mode A. At power on the last active identification code will be selected. In this mode, the transponder replies to interrogations, as indicated by the Reply Symbol. Replies do not include altitude information.

(c) To select the Mode C press the ALT key;
Powers on the transponder in Mode A and Mode C. At power on the last active identification code will be selected. In ALT mode, the transponder replies to identification and altitude interrogations, as indicated by the Reply Symbol. Replies to altitude interrogations include the standard pressure altitude received from an external altitude source, which is not adjusted for barometric pressure. The ALT mode may be used in aircraft not equipped with the optional altitude encoder; however, the reply signal will not include altitude information.

4.3 CODE SELECTION

Code selection is done with eight keys (0 - 7) that provide 4,096 active identification codes. Pushing one of these keys begins the code selection sequence. The new code will not be activated until the fourth digit is

entered. Pressing the CLR key will move the cursor back to the previous digit. Pressing the CLR key when the cursor is on the first digit of the code, or pressing the CRSR key during code entry, will remove the cursor and cancel data entry, restoring the previous code. The numbers 8 and 9 are not used for code entry, only for entering a Count Down time, and in the Configuration Mode.

SECTION 5
PERFORMANCE

No change.

SECTION 6
WEIGHT AND BALANCE

Factory installed optional equipment is included in the licensed weight and balance data in the paperwork delivered with the aircraft.

SECTION 7
DESCRIPTION AND OPERATION

7.1 GENERAL

The information contained herein supersedes the information on the BENDIX KING KT 76 A Transponder, provided in the Description & Operation Section of the basic Pilot's Operating Handbook and TC Approved Airplane Flight Manual.

For a complete description of the GTX 327 Mode A/C Transponder, refer to the GARMIN GTX 327 Mode A/C Transponder Pilot's Guide, P/N 190-00187-00, Rev. A, or later appropriate revision.

7.2 SYSTEM DESCRIPTION

The GTX 327 unit is located on the instrument panel, in the avionics column. The transponder antenna is installed on the bottom surface of the fuselage.
The transponder is connected with the blind encoder, which transfers altitude data from the pitot-static system.

Figure 7-1
Front View of the GTX 327 Unit

7.3 KEY AND KNOB FUNCTIONS

NOTE: For mode selection keys see Section 4.

IDENT- Pressing the IDENT key activates the Special Position Identification (SPI) Pulse for 18 seconds, identifying the transponder return from others on the air traffic controller's screen. The word "IDENT" will appear in the upper left corner of the display while die IDENT mode is active.

VFR- Sets the transponder code to the pre-programmed VFR code selected in Configuration Mode (this is set to 1200 at the factory). Pressing the VFR key again will restore the previous identification code.

FUNC- Changes the page shown on the right side of the display. Displayed data includes Pressure Altitude, Flight Time, Count Up timer, Count Down timer, and may include Contrast and Display Brightness, depending on configuration.

START/STOP- Starts and stops the Count Up and Count Down timers.

CRSR- Initiates entry of the starting time for the Count Down timer and cancels transponder code entry.

CLR- Resets the Count Up and Count Down timers and cancels the previous keypress during code selection.

8- Reduces Contrast and Display Brightness when the respective pages are displayed. Also enters the number eight into the Count Down timer.

9- Increases Contrast and Display Brightness when the respective pages are displayed. Also enters the number nine into the Count Down timer.

7.4 ALTITUDE TREND INDICATOR

When the "PRESSURE ALT" page is displayed, an arrow may be displayed to the right of the altitude, indicating that the altitude is increasing or decreasing. Of two sizes of arrows may be displayed depending on the rate of climb/descent. The sensitivity of these arrows is set using the GTX 327 Configuration Mode.

7.5 AUTOMATIC ALT/STBY MODE SWITCHING

The GTX 327 is configured for automatic standby switching. The mode will automatically change to ALT when the aircraft has become airborne. Also, the mode will change to STBY automatically when the aircraft has touched down. The signal for that switching the GTX 327 receives from the GPS unit depending on aircraft speed.
Additionally, a delay time can be set in the Configuration Mode, causing the GTX 327 to wait a specified length of time after landing before automatically changing to STBY mode.

Symphony AIRCRAFT

Approved Airplane Flight Manual

Model SYMPHONY SA160

SUPPLEMENT 5

BENDIX/KING DME KN 62A

This supplement must be inserted into Section 9 of the Pilot's Operating Handbook and LBA Approved Airplane Flight Manual when the Bendix/King DME KN 62A has been installed.
The Information contained herein supplements or supersedes the basic Pilot's Operating Handbook and LBA Approved Airplane Flight Manual only in those areas listed herein. For limitations, procedures, and performance information not contained in this document, consult the basic Airplane Flight Manual.

Date: ....

Approved
Transport Canada

By: ....

Issued: Feb 25, 2005

LOG OF EFFECTIVE PAGES

The following Log of Effective Pages provides a listing of all effective pages in the Supplement, as well as the date of issue or revision.

Revision Level	Date of Issue
0 (Original Issue)	Feb 25, 2005

PAGE	DATE
Title	Feb 25, 05
I	Feb 25, 05
Ii	Feb 25, 05
1 of 6	Feb 25, 05
2 of 6	Feb 25, 05
3 of 6	Feb 25, 05
4 of 6	Feb 25, 05
5 of 6	Feb 25, 05
6 of 6	Feb 25, 05

LIST OF REVISIONS

Rev. No.	Date	Page No.	Description	

SUPPLEMENT 5

TABLE OF CONTENTS

SECTION 1

GENERAL

1.1 INTRODUCTION

The KN 62 A is a compact, panel mounted, 200 channel DME that simultaneously indicates range, speed, and time to selected station or range and frequency.
The unit can be channeled manually using the frequency selection knobs or externally from an other in the aircraft installed NAV receiver.

1.2 SPECIFICATIONS

Weight:	1.18 Kg (2.6 lbs)
Power Requirements:	11 33 VDC at 15 W
Output Power:	100 W Nominal
Channels:	200
Measuring Method:	Digitally, using Large Scale Integrated circuits
Range Accuracy:	+/- .1 NM or +/- .14 %, whichever is greater, from 0 to 99.9 NM +/- 1 NM from 100 to 389 NM

SECTION 2
LIMITATIONS

No change.

SECTION 3
EMERGENCY PROCEDURES

No change.

SECTION 4
NORMAL PROCEDURES

NOTE: The KN 62A is shown in figure 7-1.

4.1 POWERING ON THE KN 62A

(a) With BAT and Avionic II switches ON, place the ON/OFF switch of the unit in ON position.

NOTE: Turn on the unit only after engine start-up. Also, turn unit off prior to engine shut down. That will protect the solid-state circuitry from short duration high voltage spikes and extend the operational life of the unit.

(b) Place the 3-position function switch on Frequency (FREQ).

(c) Select the desired frequency using the frequency selector.
   (1) Rotate the outer, larger knob to change the larger digits (1 MHz, 10 MHz)
   (2) Rotate the inner smaller knob to change the 0.1 MHz digit (0.0, 0.1, 0.2, etc.).
   When this knob is pulled “out”, it adds 0.05 MHz to the frequency and tunes in 0.1 MHz steps (0.05, 0.15, 0.25, etc.). Pushing the knob “in” subtracts 0.05 MHz from the displayed frequency.

The unit is in FREQ Mode and will display distance and the selected frequency.

SECTION 5
PERFORMANCE

No change.

SECTION 6
WEIGHT AND BALANCE

Factory installed optional equipment is included in the licensed weight and balance data in the paperwork delivered with the aircraft.

SECTION 7

DESCRIPTION AND OPERATION

7.1 GENERAL

For a complete description of the KN 62A, refer to the applicable BENDIX/KING publications.

7.2 SYSTEM DESCRIPTION

The DME system consists primarily of the KN 62A unit and the antenna that is located on the bottom of fuselage below the co-pilot's seat.
The unit has a 7-Segment gas discharge display that is dimmed automatically by a photocell. An audio output is provided for use in identifying the DME ground station being received.
The unit electronically converts to distance the elapsed time required for signals to travel to and from the ground station. The groundspeed feature incorporated in the unit measures the rate of change in DME slant range distance with time.

The DME system can be turned ON if the BAT switch and the AVIONIC II switch are in the ON position.

(a) Key and Knob Functions

The 3-position function switch 

determines both the information displayed and the channeling source. Three modes can be selected:

(1) FREQ Mode The unit is channeled internally with its own frequency selection knobs. The unit will display distance and the selected frequency.

(2) GS/T Mode The unit will hold the internally selected frequency and will display distance, groundspeed and time-to-station.

(3) RMT Mode The DME will be channeled by selecting NAV frequency on the NAV receiver. When the unit locks on a ground station, it will display distance, groundspeed and time-to-station. Prior to lock on, “dashes” will be displayed.

With the frequency selection knobs the desired DME ground station frequency is selected.

(1) The outer, larger knob changes the larger digits (1 MHz, 10 MHz).

(2) The smaller knob changes the 0.1 MHz digit (0.0, 0.1, 0.2, etc.). When pulled “out”, it adds 0.05 MHz to the frequency and tunes in 0.1 MHz steps (0.05, 0.15, 0.25, etc.). Pushing this knob “in” subtracts 0.05 MHz from displayed frequency.

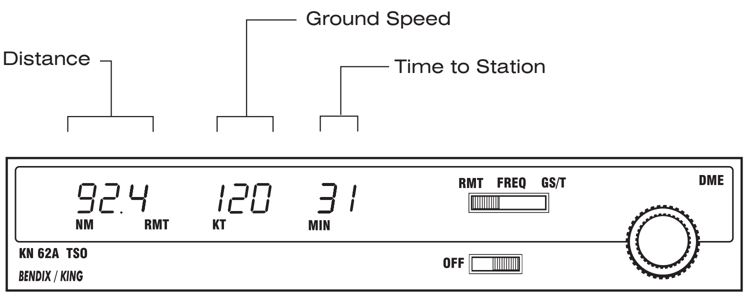


Figure 7-1
Front View of the KN 62A Unit

Symphony AIRCRAFT

Airplane Flight Manual Supplement

Model SA 160

SUPPLEMENT 6

VM 1000 Electronic power Plant Instrumentation

This supplement must be inserted into Section 9 of the Pilot's Operating Handbook and TC Approved Airplane Flight Manual when VM-1000 Electronic Power Plant Instrumentation has been installed into the SA 160 using the Vision Microsystem Inc. VM-1000 Installation Manual, P/N 5010012A , dated 2001.

The Information contained herein supplements the basic Pilot's Operating Handbook and TC Approved Airplane Flight Manual only in those areas listed herein. For limitations, procedures, and performance information not contained in this document, consult the basic Airplane Flight Manual.

Date: ....

Approved
Transport Canada

By: ....

Issued: Feb 25, 2005

LOG OF EFFECTIVE PAGES

The following Log of Effective Pages provides a listing of all effective pages in the Supplement, as well as the date of issue or revision.

Revision Level	Date of Issue
0 (Original Issue)	Feb 25, 2005

PAGE	DATE	PAGE	DATE
Title	Feb 25, 05	16 of 27	Feb 25, 05
i	Feb 25, 05	17 of 27	Feb 25, 05
ii	Feb 25, 05	18 of 27	Feb 25, 05
1 of 27	Feb 25, 05	19 of 27	Feb 25, 05
2 of 27	Feb 25, 05	20 of 27	Feb 25, 05
3 of 27	Feb 25, 05	21 of 27	Feb 25, 05
4 of 27	Feb 25, 05	22 of 27	Feb 25, 05
5 of 27	Feb 25, 05	23 of 27	Feb 25, 05
6 of 27	Feb 25, 05	24 of 27	Feb 25, 05
7 of 27	Feb 25, 05	25 of 27	Feb 25, 05
8 of 27	Feb 25, 05	26 of 27	Feb 25, 05
9 of 27	Feb 25, 05	27 of 27	Feb 25, 05
10 of 27	Feb 25, 05		
11 of 27	Feb 25, 05		
12 of 27	Feb 25, 05		
13 of 27	Feb 25, 05		
14 of 27	Feb 25, 05		
15 of 27	Feb 25, 05		

LIST OF REVISIONS

Rev. No.	Date	Page No.	Description	

SUPPLEMENT 6

TABLE OF CONTENTS

SECTION 1

GENERAL

1.1 INTRODUCTION

The VM-1000 Electronic Powerplant Instrumentation system is a multi-channels engine monitoring system that provides the pilot with all the necessary engine parameters, fuel indication and flight parameters to enable safe operation and management of the powerplant during flight. The system is comprised of an engine parameters displays VM-1000, advisory display EC-100, a fuel indicator display a digital clock a data processing units and engine sensors. The VM 1000 indicator is located on the right section of instrument panel adjacent to the radios. The fuel indicator is located underneath the VM 1000. The EC-100 is located on the upper section of the left instrument panel section.

The EC 100 display is located in the upper left instrument panel.
The system provides four several categories of easily accessed information:
- Engine information, such as power, number of cylinders, etc;
- Normal procedures checklists;
- Alerts and warnings.

The EC 100 checklist function may serve as a general guideline for the pilot while accomplishing normal procedures.
However, the pilot must be fully familiar with the normal and emergency procedures provided in Section 3 and Section 4 of this handbook.

1.2 Specifications

Weight:	2.5 Kg (5.5 lbs)
Power Requirements:	20 29 VDC
Channels:	20 channels (depending upon configuration)
Display Method:	LED and Liquid Crystal Display
Operating Temperature:	-50°C or +70°C

SECTION 2

LIMITATIONS

No change.

SECTION 3

EMERGENCY PROCEDURES

No change.

SECTION 4

NORMAL PROCEDURES-OPERATION

4.1 INITIAL SYSTEM SET-UP

The initial system set-up of the VM-1000 for your aircraft has been performed at the factory. In the event that a system re-initialisation would be required, refer to the VM-1000 installation manual provided with your aircraft for the proper procedures.

SECTION 4

NORMAL PROCEDURES-OPERATION

4.2 TACHOMETER OPERATION

The tachometer system provides both a full sweep graphic analog display and four place digital displays. When you start the engine you will see the analog graph rise in proportion to the engine speed. Full color range marks provide you with a quick reference to monitor normal, caution and red line engine RPM.

RPM:

The digital readout provides you with exact RPM information. The resolution (or incremental steps) of the digital display is 10 RPM. For example, the display might read '2400' and after you make a slight increase in power, it would read '2410'. This is a definite advantage over other digital tachs that read in less than 10 RPM steps. They change so frequently that it becomes very distracting and annoying to the pilot. We recommend using the digital display for RPM checks and letting the engine stabilize for a minimum of three seconds during the checks. The high accuracy of the tach will allow you to follow long-term performance trends of your engine and prop, such as static maximum rpm, carb heat effectiveness, and typical mag drops. These can be important indicators of engine and accessory condition.

Engine Operating Hours:

Another feature is the 'engine hours counter'. When the engine is off, the digital display reads the total accumulated engine hours to a maximum of '5999.9'. Engine hours are accumulated any time RPM is greater than 1500.

RPM Alert:

A warning alert activates whenever the engines redline is reached. The RPM display will flash until this condition is corrected.

4.3 MANIFOLD PRESSURE OPERATION

The manifold pressure system provides both a full sweep graphic analog display and three place digital display. The full sweep graphic display resolution is 1" IN. HG. The full color range marks provide you with a quick reference to manifold pressure when making fast power changes.

The digital readout provides you with precise manifold pressure information. This allows very precise power settings to be achieved. You can, for example, in stabilized conditions, watch for small changes in pressure that can indicate throttle creep or induction problems.

For new induction system designs, or modifications to existing designs, this repeatability is extremely valuable to judge the performance of the design or design changes.

Manifold Pressure Alert:

A warning alert activates whenever the engines redline is reached (typically only for turbocharged engines). The display will flash until this condition is corrected.

4.4 OIL SYSTEM OPERATION

Both oil pressure and oil temperature are displayed continuously in two separate full sweep graphic and digital areas.

Oil Pressure:

As oil pressure rises, the graph size increases proportionately. The full color range marks let you see at a glance how close to red line oil pressure you are.

The digital display reads out in 1 PSI increments to a maximum of 99. This is very useful for monitoring typical engine oil pressure trends. Because of the high accuracy and repeatability of this system, the oil pressure can be closely monitored for unusual trends. For example, if you are cruising in a stabilized condition;" and the oil pressure starts to count down, and oil temp is counting' up, this could help you to identify impending oil-loss or cooling problems.

Oil Pressure Alert:

A warning alert activates whenever the engines redline is reached. The display will flash until this condition is corrected.

Oil Temperature:

Oil temperature is displayed both graphically and digitally. As oil temperature rises, the graph size increases proportionately. This is consistent with the oil pressure display and makes it very easy to determine relationships between the two parameters.
The full color range marks let you see at a glance how close to red line oil temperature you are.

The digital display reads out in 1 degree Fahrenheit increments to a maximum of 300 degrees. This is very useful for monitoring typical

engine oil cooling system performance.

For new engine installations, you can take advantage of the high accuracy and repeatability for analyzing the engine oil cooler system efficiency. If the cooling does not seem to be effective enough, you can make changes and repeat your tests with the confidence that the next test data will reflect the results of your changes.

Oil Temperature Alert:

Your oil temp system also provides you with built-in warning annunciators. If the oil temperature rises above redline, the system captures the event and the display is flashed until the problem is corrected. This is a real advantage in the busy cockpit.

4.5 FUEL COMPUTER SYSTEM OPERATION

Fuel Pressure:

Fuel Pressure is displayed both digitally and graphically. As fuel pressure rises, the graph rises proportionately. Full color operating range marks are provided that indicates the normal operating range of fuel pressure for your engine at a glance. The digital display allows you to see small variations and make notations of typical fuel pressure behaviour.

Fuel Pressure Alert:

The system has a built-in warning system and will flash should fuel pressure move outside of the limits for your particular engine.

Fuel Flow:

Fuel Flow is displayed both digitally and graphically. As fuel flow increases, the graph increases proportionately. The digital display provides tenth gallon resolution.

There are four additional features that the fuel computer provides:

- '**REM**' - Fuel remaining onboard
- '**BRN**' - Fuel burned since last power-up
- '**HRS**' - Hours of fuel remaining
- '**ADD**' - Add fuel to computer memory.

An exclusive feature of our fuel flow computer is its ability to 'damp out' the wide variations in displayed fuel flow normally seen on other fuel flow digital readouts. The system will smooth these short term flow variations to give you a steady flow indication with NO sacrifice in accuracy.

Fuel Remaining Alert:

Your fuel computer has a built-in 'Low Fuel Remaining' warning annunciator. When the computed fuel total is less than a factory programmed amount (10 gallons standard), the display will flash.

4.6 INITIAL SET UP OF THE FUEL COMPUTER

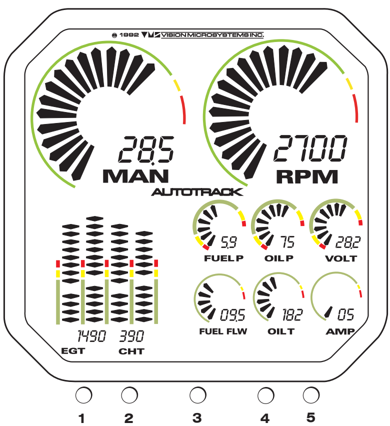
The initial fuel system set-up is performed at the aircraft factory. In the event that a system re-initialisation would be required, refer to the VM-1000 installation manual provided with your aircraft for the proper procedures.

4.7 ADDING FUEL TO THE FUEL COMPUTER

WARNING !

IMPROPER USE OF THIS FEATURE WILL GIVE YOU INCORRECT FUEL 'REM' AND 'HRS' INFORMATION. INSURE THAT YOU UNDERSTAND THE OPERATION OF THIS SYSTEM BEFORE USING IT INFLIGHT. AFTER INSTALLATION AND PERIODICALLY THEREAFTER, VERIFY THAT THE SYSTEMS ACCURACY IS ACCEPTABLE FOR YOUR INTENDED USE.

Your fuel computer has a unique feature that allows you to 'ADD' fuel according to how much has been pumped into the tank(s). You are not required to calculate the new total fuel level after adding fuel, as on many other fuel computers. This system does it for you. Follow the steps below to 'ADD' fuel to the computer, referring to 'FIGURE 6.X : VM1000 QUICK REFERENCE':



VM 1000 Quick Reference
Figure 6.x

STEP 1. Press 'BUTTON 4' until the '**ADD**' indicator activates

STEP 2. Press 'BUTTON 3 to add tens and 'BUTTON 5' to add ones to match the fuel that was pumped into the tank(s).

NOTE
To 'top off the tank(s) just press 'BUTTON 3' to run up a number more that your max capacity. The system will only add what is needed to 'fill' the computers electronic tank to its max capacity as set up in 'INITIAL SET UP OF THE FUEL COMPUTER'.

STEP 3. If you made a mistake just leave everything alone for more than 20 seconds and the computer will automatically cancel the 'ADD' mode. If you are happy with the entered value, then press 'BUTTON 4' and the new fuel will be automatically added to the prior fuel 'REM' total. Double check this new total by pressing 'BUTTON 4' until the 'REM' fuel is shown.

NOTE
In the event you want to 'zero' the current fuel remaining value, press 'BUTTON 4' until '**REM**' is displayed and continue holding it in. Simultaneously press 'BUTTON 3' and '**REM**' value will be cleared to zero.

4.8 FUEL COMPUTER NORMAL OPERATION MODES

Press 'BUTTON 4' to select the desired fuel computer operating mode. The mode is displayed below the permanent words '**FUEL FLW**' on the display:

'**FUEL FLW**'. Fuel Flow is the default mode after powering up. This mode displays the fuel Oow in the appropriate Units Per Hour both digitally and graphically. The digital section provides 0.1 unit resolution. The graphic section provides you with a quick reference of the current fuel flow.

'**REM**'. This mode displays the current fuel total remaining in gallons. It is digitally displayed in 0.1 gallon increments. This mode is ONLY usable, if you have kept the computer's memory updated with fuel information corresponding to the actual aircraft usable fuel and have always had the computer operational when fuel is being burned. The graphic display is shut off as it has no relationship to this parameter.

'**HRS**': This mode displays the calculated hours of fuel remaining (sometimes referred to as endurance), as a function of the current flow rate and current fuel total in the computer's memory. It is digitally displayed in 0.1 hour increments. This mode is ONLY usable, if you have kept the computer's memory updated with fuel information corresponding to the actual aircraft usable fuel and have always had the computer operational when fuel is being burned. The graphic display is shut off as it has no relationship to this parameter.

'**BRN**': This mode displays the gallons of fuel burned in flight since system power up. It is digitally displayed in 0.1 gallon increments. The graphic display is shut off as it has no relationship to this parameter.

'**ADD**'. This mode allows you to add fuel to the fuel computers 'electronic tank' after fuel has physically been added to the aircraft tanks. See section on 'ADDING FUEL TO THE COMPUTER'.

4.9 CYLINDER ANALYZER SYSTEM OPERATION

The engine analyzer system displays all cylinder information both graphically and digitally. Full color reference marks are provided for cylinder head green, yellow and redline temperatures.

'DIAMOND GRAPH' DISPLAY MODES:

'NORMAL MODE' - The system powers up in this mode and is ready for flight. The Diamond Graph system displays CHT between the green, yellow and red range marks, left to right, one through four. EGT graphics are displayed above the CHT redline marks where they can be easily observed. A defective CHT or EGT probe will leave the respective graph blank. A flashing CHT graph indicates a cylinder is too hot or is being shock cooled.

'LEANING MODE' - Leaning mode is selected by pressing 'BUTTON 1' while in 'Normal Mode'. The entire Diamond Graph display is temporarily used for precise high resolution leaning. The display can be returned to the 'Normal Mode' by pressing 'BUTTON 1' again. Notice that left and right 'brackets' appear on the sides of the graphs when in 'Leaning Mode'. 'Leaning mode' is not allowed if a EGT probe was defective at power up. A flashing EGT graph indicates that the leanest EGT has been detected.

DIGITAL DISPLAY MODES:

The digital display shows the temperatures for each EGT and CHT pair and periodically shows the cylinder number (ex: 'E1' 'C1'). A warning message is shown if a cylinder has reached 'red line' temperature (ex: 'h2' for hot cylinder 2), or is being 'shock cooled' (ex: 'c3' for cooled cylinder 3).

The default mode at power-up is 'PEAK DISPLAY MODE' (ex: 'P1' means EGT 1 leaned before any other during leaning mode, 'H3' means CHT 3 is the hottest). Select any combination by pressing 'BUTTON 2' as described below:

Display Mode	Cyl. Numbers	Probes displayed
Cyl. 1 Pair	'E1' 'C1'	EGT1 & CHT1
Cyl. 2 Pair	'E2' 'C2'	EGT2 & CHT2
Cyl. 3 Pair	'E3' 'C2'	EGT3 & CHT3
Cyl. 4 Pair	'E4' 'C2'	EGT4 & CHT4
Peak Mode	'P'? 'H'?	PEAK DISPLAY MODE

4.10 LEANING YOUR ENGINE:

Our exclusive automatic 'LEANING MODE' makes leaning the engine a simple operation, without the need to remember values.

STEP 1- STABILIZE: the aircraft engine temps, throttle, RPM and insure mixture is on the rich side of peak EGT. This can be verified by enriching mixture to see that all EGT values decrease. Press 'BUTTON 1' (far left) to activate the 'Lean EGT Mode'. Notice that the graphic display changes its appearance. The graph is normalized to the bottom to give you a baseline reference while leaning. Each bar represents ten degrees in this mode.

STEP 2 - LEAN: the engine mixture smoothly to start the bars climbing (about one bar per 2 seconds). The computer monitors all EGT values and detects the first EGT to lean out. When this happens, the bar graph for that EGT will begin flashing and if optionally equipped an audio/visual alert occurs. This is your signal to stop leaning. NOTE: If it looks as if the graphs will “fill up”

before you achieve leanest EGT, you can simply reinitialize by pressing 'BUTTON 1' twice which 're-arms' the Lean EGT mode and normalizes the graphs to the bottom again. Do not lean further if engine roughness occurs.

STEP 3 - ENRICH: after the lean EGT graph stops flashing, noting that the lean EGT graph (the graph that now has a single bar marking where the peak was found) goes up. This signifies that the mixture is returning to the peak value again. Set your final mixture via the bar graph or by the digital readout (now showing the leanest EGT) according to your particular engines operating handbook. Some engines require a mixture 50 - 75 degrees rich of peak at high power settings, while others allow running at peak or even leaner! Consult your engine manual.

TIP: Initially set a rich fuel flow achieving approximately 100 degrees cooler than the last known peak. The 'PEAK DISPLAY MODE' (see 'Digital Display Modes') can be used to perform this, if the system has previously found a lean EGT.

4.11 ELECTRICAL MONITORING SYSTEM OPERATION

VOLTAGE is displayed both graphically and digitally. Full color range marks provide a quick reference for fast analysis of voltage levels. As voltage rises, the graph size increases proportionately.

Additionally your system has a built-in warning system that flashes the graph when system voltage is out of nominal range (either too low or too high) .

AMPERAGE is displayed both graphically and digitally. Full color range marks provide a quick reference for fast analysis of amperage levels. As amperage rises, the graph size increases proportionately.
The digital readout displays amperage at 1 amp resolution. This is useful for troubleshooting.

The amp system functions as an 'alternator load meter' displaying current flow FROM the alternator TO the aircraft electrical system allowing you to see if a load (such as pitot heat) is really drawing current when turned on. You should see an increase on the amp display when you turn on a load, such as pitot heat for example. This tells you that the pitot heater is drawing power and is probably OK. By verifying that voltage remains the same, then it can be assumed that the alternator is supporting the additional load. This is a very handy feature for in-flight testing/verification of electrical loads and the alternator charging system.

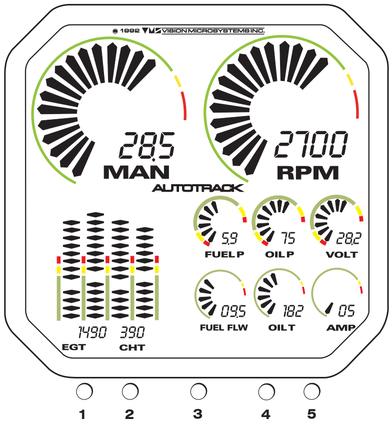
Additionally your system has a built-in warning that flashes the graph and triggers the audio/visual annunciator system (if installed) when the alternator does not produce power for the electrical system. This occurs at low amperage levels of approximately less than 2 amps.

4.12 "AUTOTRACK" SYSTEM OPERATION

The "Autotrack" system is a breakthrough in modern engine monitoring technology. Designed to reduce the pilot's workload by assisting in the tedious and often overlooked job of monitoring engine parameters for deviations from one minute to the next, "Autotrack"adds a new level of safety to engine management.

Subtle changes may occur in engine parameters that can precede major problems. These changes are often missed by even the most attentive of pilots. "Autotrack" alerts you to these changes allowing you to analyze the situation and take appropriate action.

Refer to FIGURE 6.: VM1000 QUICK REFERENCE'.



WHEN TO USE "Autotrack".

Climb - Activate during climb to alert you periodically as CHT increases and to a decrease in manifold pressure.

Cruise - Activate during cruise to alert you if any parameter begins to drift from your selected starting point.

Descent - Activate during descent to alert you to increasing manifold pressure and rising EGT due to a leaning mixture.

HOW TO USE "Autotrack":

STEP 1 - STABILIZE the aircraft. Set up your desired power and

mixture condition. Allow the engine time to stabilize (i.e, engine temps and pressures, etc.).

STEP 2 - Press 'BUTTON 3'. The 'Autotrack' indicator will activate in the display and the system will begin tracking the engine's performance from this point.

The “Autotrack” system is now armed and watching for engine deviation from the point you picked. To cancel, simply press 'BUTTON 3' again to extinguish the “Autotrack” indicator. Re-arm again at any time.

NOTE
Any important alert condition, (i.e., low fuel pressure, high CHT, etc.) automatically cancels “'Autotrack” mode.

“Autotrack” ALERT INDICATIONS:

If any engine parameter deviates beyond the initial set point, the system will flash the corresponding graphic display and the “AUTOTRACK” indicator.

If the deviation is large enough, a graphic pointer (circular sweep displays only) will show where the parameter was before the deviation occurred. This gives you a chance to evaluate the magnitude of the deviation and take the appropriate action.

To shut off the alert condition, return the parameter to its previous value (example: adjusting manifold pressure due to a climb) or simply press 'BUTTON 3' to shut off the 'AUTOTRACK' system.

If optionally equipped, an audible and visual alert will activate in the EC100 caution advisory system.

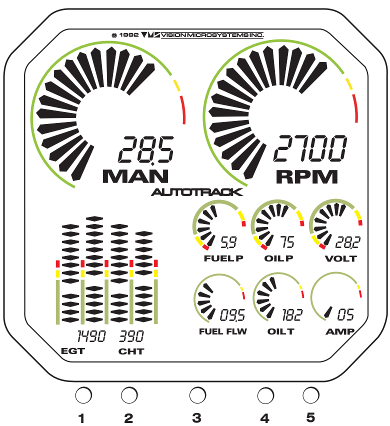
4.13 FLIGHT DATA RECORDER SYSTEM OPERATION

The Flight Data Recorder System comes standard with your VM- 1000 and is designed to allow you to review and record the performance of the engine and systems during each flight. This is extremely valuable during initial Right testing and for subsequent trend analysis.

You may retrieve data using the Flight Data Recorder at any time during the flight or even after the aircraft has been shut down for a prolonged period of time.

Minimum and maximum values are automatically recorded during the flight and can be reviewed at any time before the next flight. Taxi data is automatically omitted, as this info is generally not important. Actual time of flight is also recorded.

Refer to 'FIGURE 7: VM1000 QUICK REFERENCE'.



HOW TO USE 'Flight Data Recorder':

STEP -Press 'BUTTON 5'. The first set of data are flight minimums encountered (i.e., lowest fuel pressure, lowest voltage, amperage, etc.). Also the RPM digital display now shows the actual flight hours and tenths.

STEP 2 - Press 'BUTTON 5' again. The next set of data are flight maximums encountered (i.e., max CHT, max Oil Temp, max RPM, etc.).

STEP 3 - Press 'BUTTON 5' again. The Flight Data Recorder is shut off. The recorder data will automatically shut off in approximately 20 seconds if no button is pressed.

4.14 AIR TEMPERATURE SYSTEM OPERATION (opt.)

Both Outside Air Temp and Carburetor Air Temp are displayed, at the same time, in one compact indicator for complete air temperature information at a glance.

OUTSIDE AIR TEMPERATURE 'OAT' is displayed on the left hand side of the indicator both graphically and digitally in degrees C. Most true airspeed indicators have the temperature correction scale calibrated in Degrees C, making it easy to enter the temperature directly from the OAT display.

CARBURETOR AIR TEMP 'CAT' (or 'cabin air temp' for injected aircraft) is displayed on the right hand side of the indicator both graphically and digitally in degrees C.
As temperatures increase, the graph sizes increase proportionately. The full color range marks let you see at a glance if you are in a temperature

area conducive to icing.

The digital displays read out in 1 degree C increments to a maximum of 99 C and a minimum of -50 C. This is very useful for monitoring small changes in temperatures and for calculating temperature related parameters. For new engine installations, you can take advantage of the high accuracy and repeatability for analyzing carburetor heat effectiveness.

4.15 CHRONOMETER SYSTEM OPERATION (opt.)

The chronometer system has BOTH digital and graphic displays of various time-related parameters. The digital readout displays hours 'HRS', minutes 'MIN', and seconds 'SEC', continuously. The exclusive positive-action rotary switch is used to select the various operating modes.

The CHRONOMETER displays time in a 24 hour format. Both LOCal hours 'LOC' and universal 'UTC' time functions are provided. The stop watch timer will both 'count up' and 'count down'.

In the 'Count Down mode' the graphic display initially starts at full scale, and as time counts down, decreases in size proportionately (i.e. when half the initial time remains, half of the graph remains). This is very handy for timing instrument approaches, fuel tank changes and next fix arrival.

An additional feature is the alarm annunciator. When time expires, the entire display flashes alerting you to this fact. This is great for applications such as timing approaches, time to destination or expected checkpoint, or time to change tanks -- to name just a few.

The following page contains easy steps for initial setup and operation of your chronometer.

4.16 INITIAL CHRONOMETER SET UP

You will want to set your chronometer's universal and locall time functions. This is easily done by performing the following steps:

SETTING UNIVERSAL TIME COORDINATED (UTC):

STEP 1 - With power on, place the selector switch in the 'straight up' position (between the 'RUN' and 'STOP' positions). The display should go blank.

STEP 2 - Turn the power off for a few seconds, then back on. After a short period of time, the display will alternate between 'UTC?' or 'LOC?'.

STEP 3 - First, you should set UTC time. When the display shows 'UTC?', quickly move the selector switch to the 'HRS' position. When the 'hours' value gets to the correct hour, move the switch to the 'MIN' position. Set the 'minutes' value a few ahead of actual time to allow you to set seconds. Move the selector to 'SEC' and set it to your desired future time. Move the switch to the 'STOP' position.

STEP 4 - When the preset time equals the current time, move the selector switch to the 'straight up' position as before. The display will read 'UTCrdy'. Wait for this message to disappear, then move the selector to any desired position. (You can now check 'UTC' for

the correct universal time.)

SETTING LOCAL TIME:

STEP 1- With power on, place the selector switch in the 'straight up' position (between the 'RUN' and 'STOP' positions). The display should go blank.

STEP 2 - Turn the power off for a few seconds, then back on. The display will now alternately show 'UTC?' and 'LOC?'.

STEP 3 - When the display shows 'LOC?', move the selector switch to the 'HRS' position. When the hours value gets to the correct hour, move the switch to the 'straight up' position as before. The display will read 'LOC rdy'. Wait for this message to disappear, then move the selector to any desired position. (You can now check 'LOC' for the correct local time). NOTE: Since universal and local minutes and seconds are the same, you can only set local hours.

4.17 CHRONOMETER MODES:

TIME FUNCTIONS

'UTC' UNIVERSAL TIME COORDINATED

Simply move the selector to the 'UTC' position. The display will show universal time in hours, minutes and seconds. A distinct graphic pattern is also displayed to indicate that the 'time' mode is active.

'LOC' LOCAL TIME

Move the selector to the 'LOC' position. The display will show LOCal time in hours, minutes and seconds. A distinct graphic pattern is also displayed to indicate that one of the two 'time' modes is active.

'FLT' FLIGHT TIMER

Move the selector to the 'FLT' position. The display will show the total time in hours, minutes and seconds since the system was last 'powered-up'. This is useful for your log book entries and in- flight time keeping. Be sure to note the 'FLT' time before shutting off the master as it is cleared at next 'power-up'.

'COUNT UP' STOP WATCH FUNCTION

STEP 1 - Move the selector switch to the 'STOP' position. The display will freeze.

STEP 2 - When you want to begin timing, simply move the selector to the 'RUN' position and the display will begin counting up. An additional feature is that other functions (such as 'UTC', 'LOC', and 'FLT') are available while the stop watch is counting.

STEP 3 - When you want to stop timing, simply select 'STOP' and the time is frozen for you to observe and/or record.

'COUNT DOWN' STOP WATCH FUNCTION

STEP 1 - First, you will 'pre-set' your timer by moving the selector to the appropriate 'SEC' (seconds), 'MIN' (minutes) and 'HRS'

(hours) and allowing each to increment up to the desired value, then quickly moving the selector to the next desired position. When this is completed, move the selector to 'STOP' to hold the current value. If you made a mistake, move to the 'RUN' position for a few seconds, then set again.

STEP 2 - When you are ready to begin timing, move the selector to the 'RUN' position. The graph will fill to full scale and the timer will begin counting down. The graph now represents the percentage of 'pre-set' time remaining. This is very handy for an instrument approach or for timing when to switch fuel tanks. It relieves you of the chore of noting clock times and calculating minutes remaining, etc.

STEP 3 - When time expires, the entire display flashes alerting you to this fact. Move the selector switch to the 'STOP' position to clear the countdown timer mode. NOTE: You can dear the countdown timer mode any time it is running by moving the switch to the 'stop' position.

4.18 INITIAL EC100 SET UP

The initial set-up of the EC-100 is performed at the aircraft factory. In the event that a system re-initialisation would be required, refer to the VM-1000 installation manual provided with your aircraft for the proper procedures.

4.19 EC100 SYSTEM OPERATION

The EC100 system provides several categories of easily accessed information. Select the desired category by pressing the W button to go

forward or the 4 button to go backwards. When you see a category you want, press the T button to select it and again to see further information. The following lists the major categories that may be selected:

1) ENGINE INFORMATION: Some of the typical subjects are 'POWER', 'CYLNDRS', 'F COMP', etc.

2) AIRCRAFT OPERATIONAL CHECKLISTS: Some typical subjects are 'CLDSTRT', 'HOTSTRT', 'RUNUP', 'TAKEOFF', etc (NOTE: You may customize your checklist on paper, then send it to the factory and we will 'program' a permanent memory chip. We recommend sending this in along with your fuel calibration info. See sheets in 'Illustrations section for both fuel cal and checklist recording.)

3) ALERTS and WARNINGS: These are conditions are of importance and corrective action and/or attention is needed. When an alert/warning condition initially happens, the EC100 will automatically begin to flash the condition and a pulsing audio side tone will be momentarily present. Each time any button is pressed, the EC100 alarm will be removed for approx. 1 % minutes, allowing you to access other information.

To quickly return to the beginning display, press both the ? and ? buttons until you see the beginning display.

4.20 FUEL LEVEL SYSTEM OPERATION

The fuel level system operates automatically, once the 'FUEL LEVEL SYSTEM CALIBRATION' has been performed. The indicator displays a left, center, and right digital read-out of the units of fuel remaining of up to 99 units per tank. Additionally the left and right displays are also presented graphically to show percentage of fuel remaining for quick reference.

WARNING !

AIRCRAFT ATTITUDE AND OTHER FACTORS CAN AFFECT THE ACCURACY OF THE FUEL LEVEL READINGS. AFTER INSTALLATION AND PERIODICALLY THEREAFTER, VERIFY THAT THE SYSTEMS ACCURACY IS ACCEPTABLE FOR YOUR INTENDED USE.

If a probe is not installed or not functioning, that display is blanked. An unsteady display value should be suspect and possibly disregarded as faulty operation.

Fuel Level Alert: A low fuel level alarm has been incorporated into the system which signals you when a minimum fuel level has been reached in a given tank by displaying 'Lo' in the corresponding display area. This value is picked at our factory but may be specified upon written request at the time fuel calibration information is submitted to us.

SECTION 6
PERFORMANCE

No change.

SECTION 7

DESCRIPTION AND OPERATION

7.1 SYSTEM DESCRIPTION

Factory installed optional equipment is included in the licensed weight and balance data in the paperwork delivered with the aircraft.

LBA Approved Airplane Flight Manual

Model SYMPHONY SA160

SUPPLEMENT 7

PARKING BRAKE SYSTEM

This supplement must be inserted into Section 9 of the Pilot's Operating Handbook and TC Approved Airplane Flight Manual when a parking brake system has been installed.
The Information contained herein supplements or supersedes the basic Pilot's Operating Handbook and TC Approved Airplane Flight Manual only in those areas listed herein. For limitations, procedures, and performance information not contained in this document, consult the basic Airplane Flight Manual.

Date: ....

Approved
Transport Canada

By: ....

LOG OF EFFECTIVE PAGES

The following Log of Effective Pages provides a listing of all effective pages in the Supplement, as well as the date of issue or revision.

Revision Level	Date of Issue
0 (Original Issue)	Feb 25, 2005

PAGE	DATE
Title	Feb 25, 05
i	Feb 25, 05
ii	Feb 25, 05
1 of 4	Feb 25, 05
2 of 4	Feb 25, 05
3 of 4	Feb 25, 05
4 of 4	Feb 25, 05

LIST OF REVISIONS

Rev. No.	Date	Page No.	Description	

SUPPLEMENT 7

TABLE OF CONTENTS

SECTION 1
GENERAL

1.1 INTRODUCTION

This aircraft is equipped with a parking brake system for an easier aircraft handling on ground. This supplement covers additional instructions for aircraft operation pertaining the parking brake.

SECTION 2
LIMITATIONS

No change.

SECTION 3
EMERGENCY PROCEDURES

No change.

SECTION 4
NORMAL PROCEDURES

4.1LANDING

(a) Before Landing

Use procedure as outlined in the basic Airplane Flight Manual. Additional check the parking brake is released. The parking brake control knob must be full in.

CAUTION !

If landing is made with the parking brake set, the brakes will maintain any pressure applied after touchdown.

SECTION 5
PERFORMANCE

No change.

SECTION 6
WEIGHT AND BALANCE

Factory installed optional equipment is included in the licensed weight and balance data in the paperwork delivered with the aircraft.

SECTION 7
DESCRIPTION AND OPERATION

7.1 SYSTEM DESCRIPTION

The parking brake system consists of parking brake valve, the parking brake knob on the forward portion of the middle console, and brake lines. The brake lines from the toe brakes to the main wheel brake calipers are plumped through the parking brake valve. With the parking brake

control knob pushed in , check valves are mechanically held open allowing normal brake operation. When the knob is pulled out, the parking brake valve holds applied brake pressure, locking the brakes.
To set the parking brake, first apply brake pressure using the toe brakes and then pull the parking brake knob aft.

SECTION 8

HANDLING, SERVICING AND MAINTENANCE

8.1 GROUND OPERATION

(a) Parking

Park the aircraft as follows:

(1) If possible park the aircraft with the nose into the wind.
(2) Ensure that the flaps retracted.
(3) Set parking brake.

CAUTION !

Do not set parking brake with overheated brakes or during cold weather when accumulated moisture may freeze the brakes.

(4) Check that all electrical devices are turned OFF and that the ALT /BAT switch is in OFF position.
(5) Close cabin and baggage doors.